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Newfoundland East and Southeast Coast Herring - An Assessment of Stocks to the Spring of 2000

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Abstract

Results of analysis of data from 1998 to the spring of 2000 are presented for four herring stocks along the east and southeast coasts of Newfoundland. Commercial landings in 1998 (4200 t) were lower than in 1997 (7500 t) due primarily to poor market conditions and to reduced quotas. Landings in 1999 decreased further to 3400 t. Spring spawners of the 1991 and 1992 year classes dominated the 1998 and 1999 catches in most areas. Three series of abundance indices were available for each of the stock areas including research gill net catch rates and acoustic survey biomass estimates extending back to the early 1980's, and commercial gill net catch rates commencing in 1996. Gill net and purse seine fisher observations were also available since 1996. Stock abundances were estimated from integrated catch at age analysis for three of four stock areas and from a research gill net catchability analysis for the remaining area. The status of each stock was defined by a stock status classification system based upon environmentally dependent stock-recruit relationships. The status of the White Bay - Notre Dame Bay stock was classified as very poor. The Bonavista Bay - Trinity Bay stock was classified as good to very good, and the St. Mary's Bay - Placentia Bay and Fortune Bay stocks were classified as moderate to good.

Résumé

Les résultats de l'analyse des données obtenues de 1998 au printemps 2000 sont présentés pour quatre stocks de hareng des côtes est et sud-est de Terre-Neuve. Les débarquements commerciaux de 1998 (4200 t) ont été inférieurs à ceux de 1997 (7500 t), surtout en raison de la baisse des marchés et de la réduction des quotas. Les débarquements de 1999 ont chuté davantage pour s'établir à 3400 t. Les géniteurs de printemps des classes d'âge de 1991 et 1992 ont dominé les prises de 1998 et 1999 dans la plupart des zones. Trois séries d'indices d'abondance ont été obtenues pour chacune des zones de stock et comprenaient des taux de capture de la pêche de recherche au filet maillant, des estimations de biomasse par relevés acoustiques remontant au début des années 1980, ainsi que des taux de capture de la pêche commerciale au filet maillant débutant en 1996. Des observations de pêcheurs au filet maillant et à la senne coulissante ont aussi été obtenues depuis 1996. L'abondance des stocks a été estimée à partir de l'analyse des captures intégrées selon l'âge, pour trois des quatre zones de stock, et à partir d'une analyse de la vulnérabilité au filet maillant de la pêche de recherche, pour l'autre zone. L'état de chaque stock a été défini à l'aide d'un système de classement fondé sur des relations stock-recrutement en fonction des conditions environnementales. L'état du stock des baies White et Notre Dame a été qualifié de très faible. Celui du stock des baies Bonavista-Trinity a été de bon à très bon et celui des stocks des baies St. Mary's-Placentia et Fortune, de moyen à bon.

Introduction

There are five herring stocks distributed along the east and southeast coasts of Newfoundland (Figure 1): White Bay - Notre Dame Bay (WB-NDB), Bonavista Bay - Trinity Bay (BB-TB), Conception Bay - Southern Shore (CB-SS), St. Mary's Bay - Placentia Bay (SMB-PB), and Fortune Bay (FB). This document provides an assessment of four of these stocks to the spring of 2000; CB-SS was excluded from the analysis due to the limited commercial fishery and lack of scientific data.

In recent years, east and southeast Newfoundland herring stocks have been assessed bi-annually, most recently in the fall of 1998 (Wheeler et al. 1999). The current assessment follows closely with the methodology used in 1998.

This document is divided into several sections, outlining the steps taken to assess these herring stocks in 2000. The first section examines the commercial fishery data and the associated biological sampling used to calculate the 1998 and 1999 commercial catches at age. The next section examines the abundance indices for each of the stocks. This section is sub-divided as three series of abundance indices were available, research gill net catch rates and acoustic survey biomass estimates extending back to the early 1980's, and commercial gill net catch rates commencing in 1996. Gill net fisher observations and purse seine fisher observations were also available since 1996. The third section describes the estimation of stock sizes using integrated catch at age analysis (ICA) for three of the four stock areas, and using a research gill net catchability analysis for the fourth (FB). Risk analysis methodology is also included in this section. The document concludes with information on the current status of each stock and the associated risk analysis. Assessment proceedings and management deliberations are provided in an Appendix.

Section 1.0 - Description of the 1998 and 1999 Commercial Fisheries and Catches at Age

1.1 Biological Sampling

Biological samples are collected each year from the east and southeast Newfoundland commercial herring fisheries. As well as providing information on the age distribution of commercial landings, commercial catch at age data are used in sequential population models (eg: ICA) to estimate stock sizes.

Commercial catch data (t), by bay, month and gear type, are provided by the Policy and Economics Branch. Catch data for recent years are considered preliminary as the Policy and Economics Branch has not finalized catch statistics for these years.

1.2 The 1998 Fishery

Fisheries Management Branch formulated a two year (1997 and 1998) management plan for east and southeast Newfoundland herring based upon the 1996 Draft SSR released by Science Branch after the 1996 herring stock assessment meetings (Wheeler et al. 1997). As defined by the stock status classification system, the plan allowed for a restricted fishery in WB-NDB and BB-TB and a commercial

fishery in SMB-PB and FB. Restricted fisheries were established for the two northern areas as the status of these stocks was considered *poor to moderate* and fishing mortalities of 5% to 10% were recommended. The status of the two southern stocks was considered to be *good to very good* with recommended fishing mortalities of 20%.

The TAC's for the 1998 fisheries, based upon the two year management plan, were generally lower than those in 1997 (Table 1). Quotas were taken in one stock area only
(SMB-PB) and 1998 landings (4200 t) were lower than in 1997 (7500 t) (Tables 2 - 5 and Figure 2).

The level of biological sampling was more than adequate as 1200 herring were sampled from the 1998 fisheries (Table 6).

As in 1997 (Wheeler et al. 1999), spring spawners of the 1991 year class dominated in the commercial catches in BB-TB, and SMB-PB (Tables 8 - 11 and Figure 3). However, in WB-NDB the 1994 and 1995 year classes of spring spawners dominated, a shift from 1997 when the 1990 and 1991 year classes were dominant. In FB, spring spawners of the 1992 year class dominated, unlike in 1997 when fish age 11+ were dominant. Spring spawners accounted for greater than 75% of the catch in all areas except SMB-PB where autumn spawners accounted for 36% of the catch.

Mean weights at age (Table 12 and Figure 4) were similar from 1997 to 1998 for older ages. However, there was some evidence of increased growth for the younger ages.

1.3 The 1999 Fishery

Prior to the 1999 fishery, Fisheries Management Branch formulated a new two year (1999 and 2000) integrated management plan for east and southeast Newfoundland herring. This was based upon the 1998 SSR released by Science Branch after the 1998 herring stock assessment meetings (Wheeler et al. 1999). As defined by the stock status classification system, the plan allowed for a restricted fishery in WB-NDB and commercial fisheries in BB-TB, SMB-PB and FB. A restricted fishery was established for the northern area as the status of this stock was considered *poor to moderate* and fishing mortalities of 5% to 10% were recommended. The status of the remaining stocks was considered to be *moderate to good* with recommended fishing mortalities of approximately 20%.

TAC's for each of the stock areas were the same in 1999 as in 1998 (Table 1). Quotas were not taken in any of the stock areas and 1999 landings (3400 t) were again lower than in 1998 (4200 t) (Tables 2 - 5 and Figure 2).

The level of biological sampling was again more than adequate in 1999 as 884 herring were sampled from the fisheries (Table 7).

The distribution of year classes in the 1999 fisheries was similar to that in 1998 (Tables 8 - 11 and Figure 3). The 1991 year class of spring spawners dominated in BB-TB and SMB-PB, the 1994 and 1995 year classes of spring spawners dominated in

WB-NDB, and the 1992 spring spawning year class again dominated in FB. Spring spawners accounted for greater than 85% of the catch in all areas except SMB-PB where the percentage of autumn spawners increased to 48% of the catch. Mean weights at age, on average, were similar to 1998 (Table 12 and Figure 4).

Section 2.0 - Abundance Indices

2.1 Research Gill Net Program

The research gill net program was initiated in 1982 to derive abundance indices independent of the commercial fishery. Each year, commercial fishers are contracted to provide catch rate data and biological samples of their catch. In 2000, twenty-two fishers participated in the program (Figure 5), six in WB-NDB, eight in BB-TB, five in SMB-PB and three in FB.

Age distributions of herring (by number) from the research gill net program were available up to and including 1999; biological samples from the 2000 program have not yet been processed. In 1999, there was a broad range of spring spawning year classes which dominated the catches (Figure 6). In WB-NDB, the 1994 year class was dominant followed by the 1995 year class. In BB-TB, the 1991 year class was dominant, also followed by the 1995 year class. In SMB-PB, the 1996 year class was dominant and in FB, the 1992 year class dominated.

Spring spawning herring continued to dominate the catches in all areas (Figure 6) and represented greater than 74% of the catch in WB-NDB, BB-TB, and FB. In SMB-PB, the percentage of autumn spawners represented 33% of the catch in both 1998 and 1999.

Year classes are normally recruited to the research gill nets by age three or four years (Wheeler et al. 1997). There was substantial recruitment of the 1996 year class as 3 year olds in 1999 in SMB-PB and FB, where it accounted for 30% and 8% of the catch respectively. Similarly, there was substantial recruitment of the 1995 year class as 4 year olds in 1999 in WB-NDB and BB-TB where it accounted for approximately 30% of the catch in each area and in SMB-PB where it accounted for approximately 15% of the catch.

Catch rates at age for spring spawning herring only from the research gill net program are presented by stock area in Table 13 and Figure 7. Catch rates only are available for 2000 as these biological samples have not yet been processed. Catch rates and age distributions by bay are presented in Figures 8 - 10.

Catch rates for WB-NDB have continued to decline since last examined in 1998 (Figure 7). This decline has been continuous since 1992; catch rates in 2000 were 6% of the peak catch rates in 1992 and were the lowest in the time series. When examined by bay (Figure 8), catch rates have declined in both WB and NDB.

Catch rates for BB-TB have declined continuously since last examined and in 2000 were also the lowest in the time series (Figure 7). The decline from 1997 to 2000

occurred in both bays (Figure 9) but was more pronounced in BB where 2000 catch rates were the lowest during the time series; in TB, 2000 catch rates increased marginally from 1999.

Catch rates for SMB-PB increased from 1998 to 1999 and remained stable in 2000 (Figure 7). However, most of the increase occurred in the SMB portion of the stock area only (Figure 10).

After increasing consistently from 1992 to 1998, catch rates in FB declined both in 1999 and 2000 (Figure 7). However, catch rates are still five times higher than in any other area and are supported by a broad range of ages including substantial numbers of fish age 11+ years.

2.2 Acoustic Survey Biomass Estimates

Acoustic surveys have been conducted on an annual basis since the early 1980's as part of the research program to assess Atlantic herring stocks within the Newfoundland Region. Acoustic biomass estimates, and distributional and behavioral information are available from four surveys since the last assessment, one conducted in WB-NDB in the fall of 1998, one conducted in FB during the winter of 1999, one conducted in BB-TB in the fall of 1999, and one conducted in SMB-PB in late winter 2000. Distributional information only is available from an acoustic survey of the northeast coast of Newfoundland conducted in January 2000.

In all surveys (except the 2000 northeast coast survey), the survey area was defined as the area from the coastline to the 120 m depth contour. The survey areas were divided into strata based upon geographical features and herring distribution patterns, 22 strata in WB-NDB (Figures 13 and 14), 14 strata in FB (Figure 20), 21 strata in BB-TB (Figure 25), and 26 strata in SMB-PB (Figure 28).

The design of the acoustic surveys remained unchanged from recent surveys (Wheeler et al. 1999) and followed that described by Anderson et al. (1998).

The 1998 fall WB-NDB survey was conducted from the *Andrew and Nicholas*, a 16.8 m chartered commercial purse seining vessel. The survey commenced in Carmanville, Notre Dame Bay on November 9, 1998 and terminated in Fleur de Lys, White Bay on December 9, 1998. The total length of transects surveyed was 645 n.mi. The survey averaged 21.9 n.mi. of transects per twelve hour day and all strata were surveyed. During the survey, there was 17% downtime, one lay day, one day repairing damage to the seine, and two days due to storms.

The 1999 winter FB survey was conducted from the *Sea Gem*, a 19.8 m chartered commercial purse seining vessel. The survey commenced at Fortune on March 9, 1999 and terminated at Pass Island on March 30, 1999. The total length of transects surveyed was 288 n.mi. The survey averaged 18.5 n.mi. of transects per twelve hour day and all strata were surveyed. During the survey, there was 24% downtime, including two days due to storms.

The 1999 fall BB-TB survey was conducted from the *Three T's 1*, a 16.2 m chartered commercial purse seining vessel. The survey commenced at Grates Point, Trinity Bay on November 8, 1999 and terminated at Shoe Cove Point, Bonavista Bay on December 8, 1999. The total length of transects surveyed was 489 n.mi. The survey averaged 17.3 n.mi. of transects per twelve hour day and all strata were surveyed. During the survey, there was 15% downtime, including one lay day.

The 2000 winter SMB-PB survey was conducted from the *Valerie Amanda 2*, an 18.3 m chartered commercial purse seining vessel. The survey commenced at St. Lawrence, Placentia Bay on March 6, 2000 and terminated at St. Joseph's, St. Mary's Bay on April 5, 2000. The total length of transects surveyed was 614 n.mi. The survey averaged 19.8 n.mi. of transects per twelve hour day and all strata were surveyed. During the survey, there was 22% downtime, including one lay day and several partial days due to storms.

The January 2000 survey along the northeast coast was conducted from the *CGV Teleost*, a Departmental research trawler. The survey was designed to search for aggregations of cod in deep water inlets in Notre Dame Bay, Bonavista Bay, and Trinity Bay. It also provided distributional information on herring in the areas searched.

A *Femto* Model 9001 acoustic data acquisition system was used in all of the dedicated herring surveys in conjunction with a *BioSonics* Model 105 echo sounder and 120 kHz transducer (operating in single beam mode). The transducer, mounted in a v-fin, was deployed at a depth of approximately 3 m astern and abeam of the vessel.

The acoustic system was calibrated in September 1998, in September 1999, and again in April 2000 . The calibration parameters were as follows:

Parameters	Sept. 1998	Sept. 1999	Apr. 2000
Source Level / Receive Sensitivity:	42.37 dB	42.25 dB	42.23 dB
Fixed Receiver Gain:	11.265 dB	11.308 dB	9.928 dB
TVG Gain:	20 log R	20 log R	20 log R
Attenuation Coefficient:	0.0347 dB/m	0.0347 dB/m	0.0347 dB/m
Pulse Length:	0.4 ms	0.4 ms	0.4 ms
Average Beam Factor:	-29.4 dB	-29.4 dB	-29.4 dB

The September 1998 calibration parameters were used for the WB-NDB and FB surveys, the September 1999 parameters were used for the BB-TB survey, and the April 2000 parameters were used for the SMB-PB survey.

During the surveys, a detailed log record was maintained for each transect and also while steaming between transects. Observations were recorded of all fish concentrations (pelagic and groundfish) detected on both the echogram and oscilloscope.

The acoustic data, as recorded in the detailed log, were edited, subsequent to the surveys, using a *Femto* acoustic data editing system. All bottom signals were removed

and only those fish concentrations considered to be herring (from visual inspection of oscilloscope and echogram images) were included in the analyses.

Where concentrations warranted, and depth and weather conditions permitted, biological samples of herring were collected during the surveys using a purse seine.

Acoustic back-scatter was converted to herring density using the following target strength - fish length relationship calculated for herring by Wheeler et al. (1994):

$$T.S. = 20 \log L - 65.5$$

Mean fish lengths were derived from biological samples collected during the survey. Target strength per fish was converted to target strength per unit fish weight using mean fish weights from the biological samples. Age distributions were also calculated from the samples.

Formulas used to calculate mean densities, variances, and biomass estimates remained unchanged from previous surveys and are described in Wheeler (1991).

For the purpose of plotting herring distributions, mean densities (g/m^2) were calculated per 10 sec. (~30 m) intervals along each transect for the surveys.

2.2.1 White Bay - Notre Dame Bay

During this survey, 440 transects were surveyed (Figures 15 and 16). Herring were acoustically detected in 10 of the 23 strata surveyed. Concentrations of herring were detected and integrated in Shoal Bay and near Island Harbour, Fogo Island, in Twillingate Harbour, near Hornet Island and Thwart Island and in Botwood Run in the Bay of Exploits, in Cottrell's Cove, Besom Cove, Mill Cove and near Point Leamington in New Bay, near Robert's Arm, in Southern Arm, and near King's Point in Green Bay.

Herring were sampled by purse seine in eleven locations during the survey; in addition, a purse seine sample from the commercial fishery was available from one other location (Table 14). Mean lengths and weights were calculated for combined samples on a stratum by stratum basis (Table 15 and Figure 11) and were available for eight of the ten strata in which herring were acoustically detected. Length distributions of the combined samples by stratum are also presented in Figure 12. The mean lengths and weights were used to calculate target strengths (Table 15). Target strengths from adjacent strata were used for those strata in which herring were acoustically detected but for which no biological samples were obtained.

A biomass estimate of 19529 t was derived from the survey area (Table 16), 100% of which was in Notre Dame Bay. Approximately 27% of the estimated biomass was detected in one stratum, in the Botwood Run area (Figure 15).

Spring spawners accounted for 98.7% of the population numbers (Figure 17). The estimate of spring spawners (19200 t) represented a substantial increase from the last acoustic survey of the area in 1994 (Table 17) but was lower than estimates through the 1980's. The 1995 year class accounted for 35% of the population estimate; there was

also evidence of recruitment of the 1997 and 1998 year classes which each accounted for approximately 18% of the population estimate (Figure 17).

2.2.2 Fortune Bay

During this survey, 322 transects were surveyed (Figure 21). Herring were acoustically detected in 5 of the 10 strata surveyed. Concentrations of herring were detected and integrated near Bay L'Argent, Little Bay, in Long Harbour, near Belleoram, in Bay de L'eau, and near Harbour Breton.

Herring were sampled by purse seine in four locations during the survey (Table 18). Mean lengths and weights were calculated for combined samples on a stratum by stratum basis (Table 19 and Figure 18) and were available for four of the five strata in which herring
were acoustically detected. Length distributions of the combined samples by stratum are also presented in Figure 19. The mean lengths and weights were used to calculate target strengths (Table 19). Target strength from the adjacent stratum was used for the stratum in which herring were acoustically detected but for which no biological samples were obtained.

A biomass estimate of 30408 t was derived from the survey area (Table 20). Approximately 91% of the estimated biomass was detected in two strata, 52% in the Bay L'Argent area and 39% in Long Harbour (Figure 21).

Spring spawners accounted for 98% of the population numbers (Figure 22). The estimate of spring spawners (30000 t) represented a substantial increase from the last acoustic survey of the area (Table 21) and was the highest in the time series. The 1992 year class dominated, accounting for 75% of the population estimate (Figure 22).

2.2.3 Bonavista Bay - Trinity Bay

During this survey, 292 transects were surveyed (Figure 26). Herring were acoustically detected in 10 of the 20 strata surveyed. Concentrations of herring were detected and integrated in Trinity Bay near Hopeall, Dildo, Norman's Cove, Tickle Harbour Point, Clarenville, and Catalina, and in Bonavista Bay near Summerville, Princeton, Matthew Cove, Kate Harbour, Woody Island, Great Chance Harbour, Milners Cove, Buckley Point, Ratchet Cove, Glovertown, Culls Harbour, Long Island Reach, Chalky Cove, Dover, Cat Bay, Lewis Island, Indian Island, and Black Duck Cove.

Herring were sampled by purse seine in ten locations during the survey and by jiggers in one location (Table 22). A purse seine sample from the commercial fishery was also available from one other location. Mean lengths and weights were calculated for combined samples on a stratum by stratum basis (Table 22 and Figure 23) and were available for eight of the ten strata in which herring were acoustically detected. Length distributions of the combined samples by stratum are also presented in Figure 24. The mean lengths and weights were used to calculate target strengths (Table 23). Target strengths from adjacent strata were used for the strata in which herring were acoustically detected but for which no biological samples were obtained.

A biomass estimate of 22674 t was derived from the survey area (Table 24), 91% of which was in Bonavista Bay. Approximately 70% of the estimated biomass was detected in one stratum, in northern Bonavista Bay (Figure 26).

Spring spawners accounted for only 43% of the population numbers (Figure 27). The estimate of spring spawners (15200 t) represented a substantial decrease from the last acoustic survey of the area (Table 25). The 1997 and 1998 year classes of autumn spawners dominated, accounting for 51% of the population estimate (Figure 27).

2.2.4 St. Mary's Bay - Placentia Bay

During this survey, 356 transects were surveyed. Herring were acoustically detected in 3 of the 21 strata surveyed (Figure 29). Concentrations of herring were few and were located only near Arnold's Cove and Argentia in Placentia Bay and near Mall Bay in St. Mary's Bay.

No herring were sampled by purse seine during the survey; however, samples from the commercial fishery were available from one location near Argentia. The mean length (319 mm) and weight (247 g) from these were used to calculate a target strength which was applied to the three strata in which herring were detected.

A biomass estimate of 3810 t was derived from the survey area, 86% of which was detected in Placentia Bay (Table 26). Approximately 62% of the biomass estimate was detected one stratum, in the Arnold's Cove area (Figure 29).

Spring spawners accounted for 52% of the population numbers (Figure 30). The estimate of spring spawners (2000 t) represented a substantial decrease from the last survey of the area and was the lowest in the time series (Table 27). The 1995 year class of spring and autumn spawners dominated, accounting for 25% of the population estimate (Figure 30).

2.2.5 Northeast Newfoundland Coast

The January 2000 acoustic survey along the northeast coast included transects through the major deep water inlets in each of the bays. Herring were detected and integrated in the Halls Bay and Roberts Arm areas in Green Bay, in Bloody Reach and offshore in Bonavista Bay, and in Smith Sound in Trinity Bay (Figure 32). Herring were sampled in each of these locations using a Campelan bottom trawl (Table 28). Although none of the herring samples were aged, length distributions (Figure 31) indicated that most of the sampled herring were 1997 and 1998 year classes.

Biomass estimates were not calculated from this survey. However, the acoustic data indicate that herring were aggregated in deep water (>120 m) in all areas and deeper than the outer survey boundary in BB-TB less than two months after the completion of the 1999 fall survey.

2.3 Commercial Gill Net Logbook Program

In 1996, an initiative was undertaken by Science Branch within the Newfoundland region to increase the scientific information derived from the fixed gear herring fishery and to allow for the quantitative input of commercial fishers in the assessment process.

The long-term goal of this program is to develop a time series of catch per unit effort (CPUE) data from the commercial fixed gear fishery. These data will complement information derived from the research gill net program which has been used to track herring year class abundance since the early 1980's.

From 1996 to 1999, logbooks, prepared by Science Branch, were distributed by Fisheries Management Branch to greater than 2000 fishers along the east and southeast coasts of Newfoundland as part of the fisher's fixed gear herring licence package. In 2000, logbooks were mailed directly to approximately 2800 fishers in an effort to ensure that all fixed gear and bait fishers received a logbook.

The logbook, the format of which has been described in Wheeler et al. (1999), was designed to be completed by gill net fishers involved in the spring commercial (food fish) fishery, spring bait (lobster) fishery, and/or fall commercial fishery. Subsequent to the 1998 fishery, the logbook was revised (Appendix 1) to allow fishers to indicate the number of nights that each net was fished each time that it was hauled.

Prior to this assessment, a standardized panel area was calculated for each mesh size net by calculating the mean net panel area by mesh size for data collected from all areas between 1996 and 1999. Catch rates for the entire time series were then standardized to allow for comparisons between areas and years.

All logbooks received to September 8, 2000 have been included in this analysis.

2.3.1 White Bay - Notre Dame Bay

The number of logbook returns decreased from 13 in 1998 to 5 in 1999 and then to 4 in 2000 (Table 29 and Figure 33). The age range of fishers remained relatively stable over the same time period. The total number of nets fished decreased substantially from 49 in 1998 to 11 in 2000. The number of nights fished also decreased substantially from 486 in 1998 to 142 in 2000. The mean mesh size of nets fished fluctuated over the time period but decreased by 2% from 1999 to 2000. Mean panel area increased over the three year period and was 41% larger in 2000 than in 1998. The spatial distribution of fishing effort represented by the logbooks was similar in all years and was restricted primarily to the eastern portion of Notre Dame Bay (Figure 34). The temporal distribution of fishing effort was also similar over the time period (Figure 33). Catch rates increased slightly from 1998 to 1999 but then decreased from 1999 to 2000 and have shown a declining trend from 1996 to 2000 (Figure 35). The decline in catch rates was somewhat consistent with the observations of fishers who indicated a slight decline in abundance from average in 1998 to below average in 2000 (Figure 35). Fishers also indicated that spawning intensity has been below average each year since 1998 (Figure 35).

2.3.2 Bonavista Bay - Trinity Bay (BB-TB)

The number of logbook returns has been stable from 1998 to 2000, ranging from 5 to 7 per year (Table 29 and Figure 36). The age range of fishers increased slightly over the same time period. The total number of nets fished decreased from 1998 to 1999 but increased from 1999 to 2000. The number of nights fished exhibited similar trends. The mean mesh size of nets fished decreased marginally from 1998 to 2000 (<1%) whereas

mean panel area increased substantially (42%) over the same time period. The spatial distribution of fishing effort represented by the logbooks has been widespread and similar in most years except for 1998 when it was restricted to Trinity Bay only (Figure 37). The temporal distribution of fishing effort has also been comparable over the time series (Figure 36). Catch rates increased from 1998 to 1999 and again from 1999 to 2000. After declining from 1996 to 1998, catch rates in 2000 were comparable with peak values in 1996 (Figure 38). The increase from 1998 to 2000 was not comparable with the observations of fishers who indicated that abundance was stable and slightly above average over this time period. They also indicated that spawning intensity had decreased from above average in 1998 to well below average in 2000 (Figure 38).

2.3.3 St. Mary's Bay - Placentia Bay (SMB-PB)

The number of logbook returns decreased from 8 in 1998 to 6 in 1999 and to only 1 in 2000 (Table 29 and Figure 39). Consequently, any conclusions regarding 2000 are limited. The age range of fishers was similar from 1998 to 1999 but increased from 1999 to 2000. The total number of nets fished and nights fished decreased substantially over the time period. The mean mesh size of nets fished decreased substantially from 1998 to 1999 but increased marginally from 1999 to 2000; the mean mesh size in 2000 was 2% smaller than in 1998. The mean panel area of nets increased from 1998 to 1999 and again from 1999 to 2000; the mean panel area in 2000 was 30% larger than in 1998. The spatial distribution of fishing represented by the logbooks was restricted to one location in Placentia Bay in 2000 (Figure 40). In previous years, logbooks were returned primarily from Placentia Bay but were more broadly distributed. The temporal distribution of fishing effort in 2000 was also reduced as a consequence of being from a single logbook (Figure 39). Catch rates decreased from 1998 to 1999 and again from 1999 to 2000, continuing the trend from 1996 (Figure 41). Catch rates in 2000 were the lowest in the time series. This was comparable with the observations of fishers who indicated that abundance was stable but at a very low level (Figure 41). They also indicated that spawning intensity decreased from 1998 to 2000 and was currently well below average (Figure 41).

2.3.4 Fortune Bay (FB)

The number of logbook returns decreased from 11 in 1998 to 8 in 1999 and to 4 in 2000 (Table 29 and Figure 42). The mean age of fishers remained stable from 1998 to 2000. The total number of nets fished and nights fished decreased over the time period. The mean mesh size of nets increased from 1998 to 1999 and again from 1999 to 2000; the mean mesh size in 2000 was 5% larger than in 1998. The mean panel area of nets increased from 1998 to 1999 but decreased from 1999 to 2000; in 2000, the mean panel area was 11% larger than in 1998. Although the number of logbooks in 2000 was reduced, the spatial distribution of returns was broad and similar to previous years (Figure 40). Similarly, the temporal distribution of fishing effort was similar across the time series (Figure 42). Catch rates decreased from 1998 to 1999 but increased to a peak in 2000 (Figure 43). This was comparable with the observations of fishers who indicated that abundance had increased slightly and was well above average (Figure 43). Similarly, they also indicated that spawning intensity was stable and well above average (Figure 43).

2.4 Commercial Purse Seine Questionnaire

In 1996, a questionnaire was designed to quantitatively evaluate biological and fishery related information obtained from east and southeast Newfoundland herring purse seine fishers.

Each year, a list of names and telephone numbers has been provided by Fisheries Management Branch, DFO, of all east and southeast Newfoundland herring purse seine fishers who participated in the fishery. As the number of fishers was relatively small (Table 30), it was decided to contact all fishers rather than sub-sample the population. To minimize time and costs, the surveys were conducted by telephone.

For the three northern areas, the purse seine fishery occurred in the fall only and survey results were available to 1999. For St. Mary's Bay - Placentia Bay, there was a late winter / early spring fishery and a fall fishery. Survey results are available to 2000 for the winter / spring fishery and to 1999 only for the fall fishery.

For 1998, 30 of 34 fishers (88%) who participated in the fishery (all areas) were contacted. For 1999, 23 of 24 fishers (96%) were contacted, and to date in 2000, the only fisher who participated in the spring purse seine fishery in St. Mary's Bay - Placentia Bay was contacted. In all years, a minimum of three attempts were made to contact the remaining fishers.

The number of fishers participating in the purse seine fishery and consequently in the telephone survey remained constant from 1998 to 1999 in WB-NDB and BB-TB but decreased in SMB-PB. Overall, the numbers of fishers participating in the purse seine fishery decreased by 31% from 1998 to 1999 (Table 30).

2.4.1 Questions Regarding Herring Abundance

Three questions were asked to compare herring abundance in one's home bay in current and previous years (Figure 44). Fishers in WB-NDB and BB-TB indicated that herring abundance continued to be above average in 1998 and 1999. In SMB-PB, fishers indicated that herring abundance was well below average in 1998 and average in 1999 and 2000. Fishers were also asked to retrospectively estimate abundance in their home bay in the previous year. For all stock areas, the retrospective abundance estimates for 1997 from the 1998 survey and for 1998 from the 1999 survey were variable. In general, estimates for 1997 were closer to the current year estimate than were estimates for 1998. When asked to compare abundance in the current year to when they started fishing herring by purse seine (Figure 45), the majority of fishers in all stock areas indicated that current abundance was lower than when they first started fishing. This is a reversal of trends from the last assessment (Wheeler et al. 1999) when most fishers indicated that current abundance was greater than when they first started fishing.

2.4.2 Fleet Characteristics

All respondents were asked a series of questions to characterize the demographics of the population of purse seine fishers; these were designed to monitor changes in fishing experience and fleet capacity.

Responses indicated that the mean age of fishers remained stable over the entire time period in all areas, with most in the age 40 - 50 range (Figure 45). There was a slight increase in mean age in some areas. Responses also indicated that participants in the 1999 fishery had the same or slightly less experience, on average, than those in previous years.

The average fishing vessel length and capacity decreased over the time series in all areas except BB-TB (Table 31).

2.4.3 Questions on the Fishery

Fishers were asked questions regarding the bays and the months in which they fished (Figure 46). In WB-NDB, fishers predominantly fished in NDB; the fishery occurred from October to December and was later in 1999 than in 1998. The number of fishers in WB-NDB remained stable from 1998 to 1999. In BB-TB, there was an equal distribution of fishers between bays; the fishery also occurred from October to December and similarly was later in 1999 than in 1998. The number of fishers in BB-TB increased from 1998 to 1999. In SMB-PB, the proportion of fishers in PB increased from 1988 to 2000; there was a spring fishery which ranged from January to May and in 1998, there was also a fall fishery. The total numbers of fishers in SMB-PB decreased from 1998 to 2000.

Three questions were asked regarding abundance of herring during the current fishery compared to previous years (Figure 47). When asked to compare the number and size of herring schools detected in the current year fishery with the previous year, respondents indicated a decrease in 1999 compared to 1998 in all areas except WB-NDB. When asked to compare abundance of herring detected in the fishery compared to when they first started fishing herring, respondents indicated a decrease in 1999 in all areas.

A series of questions were asked to determine the distribution of fishing effort. To facilitate analysis, each stock area was divided into geographical sub-areas or strata (Figure 48). In all areas and years, successful sets were restricted to a few strata within each stock area; successful fishing sets were not widely distributed throughout the stock areas. The percentage of successful sets increased from 1998 to 1999 in BB-TB and SMB-PB but decreased in WB-NDB. In all areas and years, the majority of successful sets occurred during daylight hours.

The total landings of the purse seine fleet (Table 32) increased in WB-NDB and BB-TB from 1998 to 1999 but decreased in SMB-PB. The ratio of removals to landings remained stable in all areas. The principal reason for discarding in 1998 and 1999 in most areas was the size of fish (Figure 49). There were mixed responses regarding the amount of herring discarded in the current fishery compared with the previous year (Figure 50).

2.4.4 Biological Events

A question was asked to quantify observations regarding the seasonal timing of herring migration in the current year compared to the previous year (Figure 50). With the exception of BB-TB (where it was later), the seasonal timing of herring migration was perceived to be the same in 1999 as in 1998.

Section 3.0 - Estimation of Stock Sizes

3.1 Integrated Catch at Age Analysis

As in the last assessment of these stocks (Wheeler et al. 1999), integrated catch at age analysis (ICA) was used to estimate population sizes for three of the four stock areas. The ICA model could not be fitted for the FB stock as catches and fishing mortalities were very low through much of the time series. Therefore, as in 1998, a research gill net catchability analysis was used to estimate the population size for FB.

For the ICA analysis, the following input data and parameters were used:

Input Data

- Catch numbers and weights at ages 2 to 11+ from 1970 (or 1971) to 1999 (dependent upon stock area) (Tables 33 - 35)
- Age-disaggregated research gill net catch rates (Tables 36 - 38)
  - WB-NDB: spring (1988-99) and fall (1981-91)
  - BB-TB: spring (1988-99) and fall (1980-91)
  - SMB-PB: spring (1982-99)
  - FB: spring (1982-99)
- Age-aggregated acoustic biomass estimates (Tables 36 - 38)
  - WB-NDB: 1983-98
  - BB-TB: 1984-99
  - SMB-PB: 1986-2000
  - FB: 1986-99
- Natural mortality = 0.20 for all ages and years
- Maturity ogive (Wheeler et al. 1989)
  - Age 2 = 0.01
  - Age 3 = 0.35
  - Age 4 = 0.60
  - Age 5+ = 1.00
- Proportion of fishing mortality (F) and natural mortality (M) before spawning = 0.00

Input Parameters

- Number of years for separable constraint = 7 for WB-NDB, and 10 for BB-TB and SMB-PB
- Reference age for separable constraint = 5
- Constant selection pattern assumed
- Selection on last age = 1.00
- First age for calculation of reference F = 5
- Last age for calculation of reference F = 9
- All ages in catches at age weighted equally
- Acoustic biomass estimates treated as estimates of absolute stock size
- Research gill net catch rates treated as proportionate indices of abundance
- Range of feasible fishing mortalities = 0.02 to 3.00

- Equal weights assigned to the abundance indices relative to the catch at age
- Estimate of the extent to which errors in each age of the age structured indices are correlated = 1.00

All input parameters were the same as in the 1998 assessment (Wheeler et al. 1999) with two exceptions. In 1998, the number of years of separable constraint for all areas was 10. Also, in 1998, the estimate of the extent to which errors in each age of the age structured indices are correlated was set to 0.50 for WB-NDB.

ICA population numbers at age, by year and by stock area are given in Tables 39 - 41. Biomass estimates, by year and stock area, are given in Figure 51; results from the last assessment (Wheeler et al. 1999) are provided for comparison.

3.2 Research Gill Net Catchability Analysis

As in the last assessment, the current stock size for the FB stock was estimated using a research gill net catchability analysis. The catchability coefficient (Table 42) was applied to current research gill net catch rates to estimate age 5+ population numbers. Population numbers were converted to biomass using mean weights from the research gill net data.

Population estimates derived from the catchability coefficient were compared to acoustic biomass estimates (Table 42); the most recent estimates for 1999 were within 25% of each other.

3.3 Stock-recruit Relationships and Stock Status Classification System

As in recent assessments of these stocks (Wheeler et al. 1997, 1999), stock status is described in relation to a stock status classification system. This system links exploitation rates to recruitment estimates at given spawning stock levels based upon stock specific environmentally dependent stock-recruit relationships. Stock status zones are then defined along these stock-recruit curves with appropriate exploitation levels (Figure 52). The environmentally dependent stock-recruit relationships for WB-NDB, BB-TB, and SMB-PB were unchanged from the 1998 assessment (Wheeler et al. 1999).

3.4 Projections and Risk Analysis

For the three stocks assessed by ICA (WB-NDB, BB-TB, and SMB-PB), two year projections (2001 and 2002) were run using the integrated catch projection (ICP) software of Patterson (1998).

For these projections, catches in 2000 were assumed to approximate 1999 catches; ie. WB-NDB = 1000 t, BB-TB = 1500 t, and SMB-PB = 500 t. For WB-NDB, projections were run at fishing mortalities of F = 0.00 and F = 0.05, the lower and upper recommended fishing mortalities for zone 1 of the stock status classification system (Figure 52). For BB-TB, projections were run at fishing mortalities of F = 0.10 and F = 0.20, the lower and upper recommended mortalities for zone 3, and for SMB-PB, projections were run at fishing mortalities of F = 0.05 and F=0.10, the lower and upper mortalities for zone 2.

The following parameters were used in the projections:

Projection Parameters

- Random number seed = 120
- Lag in years between spawning and recruitment at age = 2
- Single fleet per stock area with 100% retention at all ages
- Mean weights at age in the catch and discards equal to 1999 weights at age
- Mean natural mortality from 1994 to 1999 = 0.20
- Mean maturity ogive from 1994 to 1999
- Mean weights at age from 1994 to 1999
- Geometric mean recruitment
- Range of years for estimating recruitment = 1970 (or 1971) to 1999
- Stock-recruit residuals assumed to be auto-correlated
- Recruitment estimates for the last year of the catch at age data and for the subsequent year were taken from the ICA model fit
- 5%, 25%, 50%, 75% and 95% percentile points were used to calculate the distribution of fishing mortality, yield, stock size, and recruitment
- 200 simulations were run for making estimates of uncertainty, using random draws of population parameters as estimated from the ICA maximum likelihood fit

Results of the projections are provided in Table 43. A risk analysis of the probability that spawning stock biomass would be less than the reference biomass levels of the stock status classification system was also calculated. For WB-NDB, the risk was calculated that spawning biomass would be less than the reference level for zone 1. For BB-TB, the risk was calculated that spawning biomass would be less than the reference level for zone 4, and for SMB-PB, the risk was calculated that spawning biomass would be less than the reference level for zone 2.

Section 4 - Stock Status

4.1 White Bay - Notre Dame Bay

4.1.1 The Fishery

Landings in 1999 were 1050 t, 97% of which were taken by purse seines during the fall (Table 2), and mostly from the eastern portion of the stock area (Figure 48).

The commercial fishery was dominated by age 4 and 5 herring (1995 and 1994 year classes) which accounted for 85% (numbers) of the landings (Figure 3).

4.1.2 Resource Status

Research gill net catch rates have decreased continuously since 1992; catch rates in 2000 were the lowest in the 13 year time series and were 94% lower than the peak in 1992 (Figure 7). Similar to the commercial fishery, the 1994 and 1995 year classes dominated in the research gill nets, accounting for 75% of the catch in 1999 (Figure 6).

The age 5+ biomass estimated from the most recent acoustic survey in the fall of 1998 was 1600 t (Figure 53). The previous acoustic estimate in 1994 was 1100 t.

However, the 1995 year class (at age 3) dominated in the 1998 survey and the total biomass from the survey was 19500 t.

Commercial gill net catch rates have decreased continuously from 1996 to 2000 (Table 29) and are currently 94% lower than in 1996. These same gill net fishers indicated that herring abundance was well below average in 2000 (Figure 35).

Purse seine fishers indicated that herring abundance was well above average in 1999 (Figure 44) but much lower than when they first started fishing herring.

The 2000 mature biomass estimate from the integrated catch at age analysis was 22700 t (Figure 53), a slight increase from 1998.

Recruitment continued to be poor. The dominant 1994 year class was estimated from the ICA to be 70% of the strength of the moderately strong 1982 year class (Figure 57). The 1995 year class was only 35% of the strength of the 1982 year class.

4.1.3 Summary

With the exception of one indicator (purse seine fisher observations), all indices show that this stock continues to be low in abundance. Based upon the stock status classification system, the current analysis indicates that the stock should be classified in zone 1, ***very poor*** (Figure 53).

The stock continues to be at a low level relative to peak levels in the mid 1970's due to poor recruitment through the 1980's and 1990's. Although the 1994 and 1995 year classes are currently dominant, they are not large year classes. Pre-recruit estimates of the 1997 and 1998 year classes indicate that they are not large.

Risk analysis indicates that with 2001 and 2002 catches in the order of 1300 t and 1180 t respectively, there is greater than 50% probability that the mature stock biomass will remain in zone 1 of the stock status classification system (Table 43). This probability decreases by approximately 7% if catches are less than 100 t.

4.2 Bonavista Bay - Trinity Bay

4.2.1 The Fishery

Landings in 1999 were 143 t (Table 3), approximately 56% of which were taken by purse seines in a fall fishery in both bays (Figure 48). A spring bar seine fishery in both bays accounted for 30% of the landings.

The commercial fishery was dominated by age 8 herring (1991 year class) which accounted for 45% of the landings (Figure 3). This year class has dominated in the fishery since 1995.

4.2.1 Resource Status

Research gill net catch rates have decreased continuously since 1997; catch rates in 2000 were the lowest in the 13 year time series and were 85% lower than the peak in 1997 (Figure 7). Similar to the commercial fishery, the 1991 year class dominated in the

research gill nets, accounting for 55% of the catch in 1999 (Figure 6). The 1994 and 1995 year classes accounted for 20% and 30% of the catch respectively.

The age 5+ biomass estimated from an acoustic survey in the fall of 1999 was 10400 t (Figure 54). This was a decrease from the previous acoustic estimate (31200 t) in 1996. However, the 1997 year class (at age 2) dominated in the 1999 survey and the total biomass from the survey was 22700 t. There was also evidence of recruitment of the 1998 and 1999 year classes in the survey.

Commercial gill net catch rates decreased from 1996 to 1998 and increased from 1998 to 2000 and are currently similar to the peak in 1996 (Table 29). These same gill net fishers indicated that herring abundance was average in 2000 (Figure 38).

Purse seine fishers indicated that herring abundance was above average in 1999 (Figure 44) but somewhat lower than when they first started fishing herring.

The 2000 mature biomass estimate from the sequential population model was 30900 t (Figure 54), an increase since 1998.

The 1991 year class, estimated to be approximately 60% of the strength of the 1982 year class (Figure 57), continued to dominate. The 1995 year class was estimated to be 39% the strength of the 1982 year class.

4.2.3 Summary

Abundance indices for this stock provide mixed signals. Research gill net catch rates and acoustic biomass estimates indicate that the stock is declining in abundance. Commercial gill net catch rates and observations of fishers are more positive. Based upon the stock status classification system, the current analysis indicates that this stock should be classified in zone 4, ***good to very good*** (Figure 54).

However, the stock is still at a low level relative to peak levels in the mid 1970's. Although the 1991 and 1995 year classes have dominated in the 1990's, they are not strong year classes. Pre-recruit estimates of the 1998 and 1999 year classes also indicate that they are not large.

Risk analysis indicates that with 2001 and 2002 catches of 4650 t and 3580 t respectively, there is a 32% - 40% probability that the mature biomass will decrease to zone 3 within the stock status classification system (Table 43). By reducing catches to approximately 2000 t, this probability would be reduced by 8%.

4.3 St. Mary's Bay - Placentia Bay

4.3.1 The Fishery

Landings in 1999 were 330 t (Table 4), 99% of which were taken by purse seines during the late winter and spring in Placentia (Figure 48).

The commercial fishery was dominated by the 1991 year class, which accounted for 40% of the landings (Figure 3). This year class has dominated the commercial fishery since 1995.

4.3.2 Resource Status

Research gill net catch rates decreased from 1996 to 1998 and increased from 1998 to 2000 (Figure 7). Unlike the commercial fishery, the 1996 year class dominated in the research gill nets, accounting for approximately 30% of the catch in 1999 (Figure 6). The 1991 and 1995 year classes each accounted for approximately 15% of the catch.

The age 5+ biomass estimated from an acoustic survey in the early spring of 2000 was 1900 t (Figure 55). This was a decrease from the previous acoustic estimate (10700 t) in 1998. The 1995 year class (at age 5) dominated in the 2000 acoustic survey. There was limited evidence of the 1996 year class in the survey.

Commercial gill net catch rates have decreased continuously from 1996 to 2000 and are currently 68% lower than in 1996 (Table 29). The lone gill net fisher who returned a logbook in 2000 indicated that herring abundance was well below average (Figure 41). He also indicated that herring abundance was average (Figure 44) but much lower than when he first started fishing herring.

The mature biomass estimate for 2000 from the sequential population model was 14500 t (Figure 55), similar to the mature biomass from the 1998 assessment (14800 t) of the stock.

The 1991 year class, dominant in the commercial fishery, was estimated to be of similar strength to the 1982 year class (Figure 57). The 1995 and 1996 year classes, dominant in the acoustic survey and research gill net catches respectively, were each estimated to be approximately 60% the strength of the 1982 year class.

4.3.3 Summary

With the exception of research gill net catch rates in St. Mary's Bay, all indices show that this stock is at a similar or lower level than in 1998. Based upon the stock status classification system, the current analysis indicates that the stock should be classified in zone 3, ***moderate to good*** (Figure 55).

The stock is at a moderate level relative to peak levels in the early 1970's. However, there is no evidence of strong recruitment of recent year classes.

Risk analysis indicates that with 2001 and 2002 catches in the order of 1380 t and 1300 t, there is a 29% to 34% probability that the mature stock biomass would decrease to zone 2 within the stock status classification system (Table 43). This increases by 8% - 12% with catches of 2620 t and 2200 t. With any of the above catch levels, there is greater than 80% probability that the mature stock biomass would not increase to zone 4.

4.4 Fortune Bay

4.4.1 The Fishery

Landings in 1999 were 455 t, 74% of which were taken by bar seine during the spring, primarily in Long Harbour (Table 5).

The commercial fishery was dominated by age 7 herring (1992 year class), which accounted for 50% of the landings (Figure 3). Fish aged 11+, which had been dominant until 1997, still accounted for 30% of the landings.

4.4.2 Resource Status

Research gill net catch rates peaked in 1998 and decreased in 1999 and 2000 (Figure 7); catch rates in 2000 were 42% lower than in 1998 but were still high relative to other stock areas. Similar to the commercial fishery, the 1992 year class dominated in the research gill nets, accounting for 29% of the catch in1999 (Figure 6). Fish aged 11+ and the 1991 year class accounted fo 27% and 19% of the catch respectively. There was also evidence of the recruitment of the 1996 year class.

The age 5+ biomass, estimated from an acoustic survey in the early spring of 1999, was 12400 t (Table 42), a decrease from the previous acoustic estimate (15700 t) in 1997. However, the 1996 year class (at age 3) dominated in the 1999 acoustic survey; the total biomass estimate for the survey was 30400 t. There was no evidence of recruitment of more recent year classes in the survey.

Commercial gill net catch rates have fluctuated at high levels from 1996 to 2000 (Table 29) and are currently at the highest level in the five year time series. These same gill net fishers indicated that herring abundance was well above average in 2000 (Figure 43).

The age 5+ biomass from the research gill net catchability analysis was 15000 t (Table 42), a decrease since the 1998 assessment (27300 t) of the stock. This decrease is consistent with the decrease in research gill net catch rates, because it is calculated directly from research gill net catch rates.

4.4.3 Summary

Abundance indices for this stock provide mixed signals. Research gill net catch rates and the acoustic biomass estimate indicate that the mature biomass has declined in abundance since the last assessment. Commercial gill net catch rates and observations of fishers are more positive. Based upon the stock status classification system, the current analysis indicates that the stock should be classified in zone 3, ***moderate to good*** (Figure 56).

Fish aged 11+ continue to contribute significantly to the spawning biomass and there nas been very limited fishing mortality.

Risk analysis indicates that with 2001 and 2002 catches in the order of 1000 - 2000 t, there is a 32% to 43% probability that the mature biomass would decrease to zone 2 within the stock status classification system (Table 43). With either of the above

catch levels, there is greater than 60% probability that the mature biomass would not increase to zone 4.

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Table 1. Landings and TAC's ('000 t) of east and southeast Newfoundland herring, by stock area

	WB-NDB		BB-TB		SMB-PB		FB	
Year	Catch	TAC	Catch	TAC	Catch	TAC	Catch	TAC
1977	11.6	10.0	12.0	9.5	3.3	3.3	0.6	3.4
1978	13.4	7.9	8.0	7.8	3.5	4.0	1.0	1.0
1979	15.7	11.5	9.8	8.4	3.6	3.4	1.2	1.0
1980	6.5	5.3	5.4	4.4	2.5	2.5	0.5	1.0
1981	4.7	5.3	4.0	4.8	0.6	1.2	0.1	0.2
1982	2.0	1.2	0.5	0.7	0.1	0.0	0.1	0.0
1983	0.4	0.0	0.1	0.0	0.1	0.0	0.1	0.0
1984	1.5	1.5	0.2	0.4	0.1	0.0	0.1	0.0
1985	1.8	2.0	0.6	0.8	0.1	0.6	0.1	0.3
1986	2.8	5.5	1.8	3.8	0.1	2.1	0.1	0.7
1987	13.5	32.5	6.1	13.7	0.3	2.5	0.1	2.4
1988	7.4	34.7	11.7	16.2	1.1	8.9	0.1	4.7
1989	6.4	14.0	4.9	6.9	0.4	1.5	0.1	1.5
1990	5.1	16.5	3.7	23.4	0.5	1.5	0.1	1.5
1991	8.7	13.5	9.1	10.0	1.0	1.5	0.1	1.5
1992	5.7	13.5	4.7	10.0	0.9	1.5	0.1	1.5
1993	1.7	13.5	2.9	10.0	1.2	1.5	0.2	1.5
1994	1.4	13.5	2.7	10.0	1.0	1.5	0.3	1.5
*1995	1.6	1.2	1.4	1.0	0.8	1.1	0.5	1.5
*1996	0.6	1.6	1.1	1.4	0.5	0.7	0.1	0.5
*1997	2.2	4.9	1.1	1.6	3.9	6.6	0.1	5.4
*1998	0.7	2.5	1.0	2.5	2.3	2.0	0.1	5.4
*1999	1.1	2.5	1.4	2.5	0.3	2.0	0.5	5.4

* provisional

Table 2. White Bay (WB) - Notre Dame Bay (NDB) herring landings and TAC's (t), by gear, 1988-99.

		Gear							
Year	Area	Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap	Total	TAC
1988	WB	1822	-	-	20	65	-	1907	
	NDB	4410	-	-	284	704	113	5511	
	Combined	6232	-	-	304	769	113	7418	34700
1989	WB	672	-	-	-	113	10	795	
	NDB	4372	-	-	45	976	206	5599	
	Combined	5044	-	-	45	1089	216	6394	14000
1990	WB	108	-	-	1	90	21	220	
	NDB	3398	-	-	30	1289	151	4868	
	Combined	3506	-	-	31	1379	172	5088	16500
1991	WB	1318	-	-	2	311	23	1654	
	NDB	6026	-	-	80	946	41	6872	
	Combined	7344	-	-	82	1257	64	8526	13500
1992	WB	1292	-	-	-	252	4	1548	
	NDB	2983	-	-	6	1101	48	4138	
	Combined	4275	-	-	6	1353	52	5686	13500
1993	WB	121	-	-	-	34	-	155	
	NDB	685	-	-	104	739	7	1535	
	Combined	806	-	-	104	773	7	1690	13500
1994	WB	144	-	-	5	20	62	231	
	NDB	226	-	-	84	833	8	1151	
	Combined	370	-	-	89	853	70	1382	13500
1995*	WB	200	-	-	-	15	9	224	
	NDB	454	-	-	25	894	-	1373	
	Combined	654	-	-	25	909	9	1597	1200
1996*	WB	153	-	-	-	-	-	153	
	NDB	252	-	-	-	229	-	481	
	Combined	405	-	-	-	229	-	634	1600
1997*	WB	12	-	-	-	9	-	21	
	NDB	2141	-	-	-	11	7	2159	
	Combined	2153	-	-	-	20	7	2180	4900
1998*	WB	106	-	-	-	1	7	114	
	NDB	500	-	-	7	30	2	539	
	Combined	606	-	-	7	31	9	653	2500
1999*	WB	-	-	-	-	-	-	-	
	NDB	1011	-	-	-	34	-	1045	
	Combined	1011	-	-	-	34	-	1045	2500

* provisional

Table 3 Bonavista Bay (BB) - Trinity Bay (TB) herring landings and TAC's (t), by gear, 1988-99.

Year	Area	Gear						Total	TAC
		Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap		
1988	BB	7550	-	-	151	144	-	7845	
	TB	3410	-	-	317	93	82	3902	
	Combined	10960	-	-	468	237	82	11747	16200
1989	BB	1459	-	-	13	92	-	1564	
	TB	3149	-	-	141	65	6	3361	
	Combined	4608	-	-	154	139	6	4925	6900
1990	BB	904	-	-	2	126	7	1039	
	TB	1819	-	-	721	84	24	2648	
	Combined	2723	-	-	723	210	31	3687	23400
1991	BB	4458	-	-	7	147	43	4655	
	TB	3760	-	-	567	85	-	4412	
	Combined	8218	-	-	574	232	43	9067	10000
1992	BB	4372	-	-	3	197	2	4574	
	TB	52	-	-	63	48	-	163	
	Combined	4424	-	-	66	245	2	4737	10000
1993	BB	2487	-	-	3	237	-	2727	
	TB	31	-	-	16	79	1	127	
	Combined	2517	-	-	19	316	1	2854	10000
1994	BB	1984	-	-	1	356	-	2341	
	TB	39	-	-	235	70	-	344	
	Combined	2023	-	-	236	426	-	2685	10000
1995*	BB	338	-	-	7	522	-	867	
	TB	278	-	-	117	93	2	490	
	Combined	616	-	-	124	615	2	1357	1000
1996*	BB	344	-	-	-	300	-	644	
	TB	318	-	-	13	78	-	409	
	Combined	662	-	-	13	378	-	1053	1400
1997*	BB	321	-	-	-	72	-	393	
	TB	329	-	-	210	129	41	709	
	Combined	650	-	-	210	201	41	1102	1600
1998*	BB	331	-	-	96	148	-	575	
	TB	333	-	-	8	22	22	385	
	Combined	661	-	-	104	170	22	960	2500
1999*	BB	564	-	-	222	95	-	881	
	TB	245	-	-	208	100	-	553	
	Combined	809	-	-	430	195	-	1434	2500

* provisional

Table 4 St Mary's Bay (SMB) - Placentia Bay (PB) herring landings and TAC's (t), by gear, 1988-99.

Year	Area	Gear						Total	TAC
		Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap		
1988	SMB	-	-	-	-	25	-	25	
	PB	887	-	-	12	176	-	1075	
	Combined	887	-	-	12	201	-	1100	8900
1989	SMB	-	-	-	-	8	-	8	
	PB	263	-	-	1	131	2	397	
	Combined	263	-	-	1	139	2	405	1500
1990	SMB	-	-	-	-	18	-	18	
	PB	379	-	-	-	144	-	523	
	Combined	379	-	-	-	162	-	541	1500
1991	SMB	-	-	-	-	16	-	16	
	PB	742	-	-	110	104	34	990	
	Combined	742	-	-	110	120	34	1006	1500
1992	SMB	-	-	-	-	1	-	1	
	PB	780	-	-	2	123	-	905	
	Combined	780	-	-	2	124	-	906	1500
1993	SMB	262	-	-	-	3	-	265	
	PB	681	-	-	154	119	-	954	
	Combined	943	-	-	154	122	-	1219	1500
1994	SMB	-	-	-	-	0	-	0	
	PB	680	-	-	77	195	10	962	
	Combined	680	-	-	77	195	10	962	1500
1995*	SMB	219	-	-	-	-	-	219	
	PB	349	-	-	76	135	-	560	
	Combined	568	-	-	76	135	-	779	1100
1996*	SMB	217	-	-	-	-	-	217	
	PB	229	-	-	15	38	-	282	
	Combined	446	-	-	15	38	-	499	700
1997*	SMB	1587	-	-	-	-	-	1587	
	PB	2187	-	-	99	20	-	2306	
	Combined	3774	-	-	99	20	-	3893	6600
1998*	SMB	740	-	-	-	14	-	754	
	PB	1570	-	-	-	5	-	1575	
	Combined	2310	-	-	-	19	-	2329	2000
1999*	SMB	-	-	-	-	-	-	-	
	PB	330	-	-	-	1	-	331	
	Combined	330	-	-	-	1	-	331	2000

* provisional

Table 5 Fortune Bay (FB) herring landings and TAC's (t), by gear, 1988-99.

Year	Area	Gear						Total	TAC
		Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap		
1988		-	-	-	-	89	-	89	4700
1989		-	-	-	3	104	2	109	1500
1990		-	-	-	-	92	-	92	1500
1991		-	-	-	-	123	-	123	1500
1992		-	-	-	-	131	-	131	1500
1993*		-	-	-	-	179	-	179	1500
1994*		1	-	-	2	248	-	251	1500
1995*		5	-	-	4	459	-	468	1500
1996*		-	-	-	35	30	4	69	500
1997*		-	-	-	91	28	23	142	5400
1998*		-	-	-	-	1	-	1	5400
1999*		-	-	-	338	29	89	455	5400

* provisional

Table 6. Commercial catch (t) and number of fish sampled (bold print) for 1998, by stock area, gear type and month. Boxed areas indicate the catch - sample combinations used for calculating commercial catch at age.

AREA	GEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
WB-NDB	Gillnet					1 50				1	30 50		
	Purse seine										191	276 100	136
	Bar Seine										7		
	Trap					1			1	7	1 50		
BB-TB	Gillnet				24 100	26					60	60 100	1
	Purse seine										563 100	66	35
	Bar Seine				8 50						44	52	
	Trap										22 100		
SMB-PB	Gillnet		1 50			5						14 50	
	Purse seine	556 50	464 50	739 100	186	59 50						178	99 50
	Bar Seine												
	Trap												
EB	Gillnet					1 50							
	Purse seine												
	Bar Seine												
	Trap												

Table 7. Commercial catch (t) and number of fish sampled (bold print) for 1999, by stock area, gear type and month. Boxed areas indicate the catch - sample combinations used for calculating commercial catch at age.

AREA	GEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
WB-NDB	Gillnet				10	22 50	2						
	Purse seine										3 50	934 100	74
	Bar Seine												
	Trap												
BB-TB	Gillnet				95 100	39 50				1	26	33 50	3
	Purse seine										523 47	143 141	143 50
	Bar Seine				122	87 50					24	198 46	
	Trap												
SMB-PB	Gillnet												
	Purse seine			330 50									
	Bar Seine												
	Trap												
EB	Gillnet			12 50	18								
	Purse seine												
	Bar Seine			96 50	140 50	101							
	Trap					66							

Table 8. Commercial catch at age of spring and autumn spawning herring for White Bay - Notre Dame Bay 1970-1999

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	10	1	5	1	1	2	55	50	1	1	115	445	78	1	6
3	1	129	280	727	4	128	24	1671	55	60	46	152	371	35	12
4	12	88	2096	1411	123	215	506	107	2034	50	1240	41	332	46	124
5	24	161	353	2625	3142	453	237	465	317	2928	92	1231	59	23	1218
6	24	64	69	761	5446	5438	869	184	1034	323	1080	63	268	14	73
7	972	425	122	719	1193	7069	10893	793	517	1410	17	805	34	93	114
8	11	16184	403	654	697	1123	17145	7363	2509	767	496	64	258	1	157
9	83	233	1361	416	1506	838	1328	12675	10807	2222	179	344	19	26	37
10	159	254	205	1625	855	810	3364	1055	11756	14413	1450	194	192	4	122
11+	275	3105	808	794	2378	3999	8535	15707	14379	27508	14653	10908	4059	805	1038
Total	1572	14645	6015	9664	15340	20076	42957	40074	43410	49683	19369	14248	5669	1052	3802

Age	1985	1986	1987	1988 b	1989 c	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
1	1	195	26	3113	1	1	2273	1	1	1	1	1	1	1	1
2	3	29	1109	407	23	1	29	940	1	1	1	159	2	1	1
3	187	975	324	1044	126	1936	386	207	96	1	96	1	698	802	81
4	350	2945	7201	291	613	265	16183	942	31	1054	609	3	2	871	1755
5	240	308	25843	2984	124	637	1542	8940	263	121	2747	484	63	21	1450
6	1486	667	1651	11819	3106	240	553	463	3614	1674	129	1194	3420	14	1
7	108	1258	1067	1036	10566	2451	103	371	75	2199	701	23	2939	359	3
8	275	198	2088	1137	370	7360	2145	211	199	108	1513	162	51	225	83
9	94	162	399	1454	1081	532	4432	722	70	192	183	474	209	219	180
10	81	179	442	315	844	1132	537	2796	544	49	127	1	359	42	3
11+	2110	1973	4566	2943	2178	1148	2201	3509	861	441	337	91	427	88	9
Total	4935	8889	44712	26543	19034	15723	30384	19122	5755	5841	6444	2593	8171	2640	3567

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	53	1	1	6	1	1	1	1	71	1	72	1	1
4	1	1	17	7	11	64	31	45	6	1	13	13	26	74	60
5	26	6	74	22	124	3	35	35	24	10	13	86	62	25	409
6	10	14	79	25	10	25	51	85	155	267	23	11	16	23	66
7	39	11	67	60	48	16	20	54	171	172	272	1	12	1	30
8	60	26	1	25	2	21	40	1	24	160	4	100	9	1	8
9	20	17	164	13	46	3	46	94	2	133	19	1	42	6	7
10	11	19	81	97	7	2	4	1	130	1	1	4	1	1	3
11+	172	291	562	298	346	302	329	182	238	298	450	65	23		24
Total	342	388	1100	550	557	444	559	500	753	1045	868	284	265	134	610

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	11	1	1	1	1
3	1	10	2	1	1	1	1	1	1	1	1	19	1	1	1
4	29	67	297	92	65	130	188	109	1	7	11	1	56	97	204
5	94	69	409	115	12	65	450	187	48	70	37	1	72	22	123
6	333	79	156	45	5	52	98	172	78	60	2	80	20	1	163
7	137	373	112	20	574	84	36	48	113	137	120	16	233	1	41
8	32	68	630	7	70	37	128	46	79	25	3	3	1	11	1
9	23	6	152	560	1	1	249	80	42	4	24	3	69	21	1
10	16	1	10	6	533	4	120	19	21	1	1	3	1	1	1
11+	74	42	108	306	29	577	2733	613	349	14	204	1	34	1	122
Total	735	717	1938	1154	1292	953	4005	1277	734	341	415	129	489	158	659

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total	1914	15033	7115	10544	15946	20520	43516	40574	44163	50728	20237	14532	3440	15	164
% SS	82.1	97.4	84.5	94.8	96.3	97.8	98.7	98.8	98.3	97.9	95.7	98.0	99.4	93.3	0.6
% AS	17.9	2.6	15.5	5.2	3.7	2.2	1.3	1.2	1.7	2.1	4.3	2.0	0.6	6.7	99.4

	1985	1986	1987	1988 b	1989 c	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
Total	5670	9606	46850	27697	20326	16676	34389	20399	6489	6182	6859	2722	8660	2801	4226
% SS	87.0	92.5	95.8	95.8	93.6	94.3	88.4	93.7	88.7	94.5	94.0	95.3	94.4	94.4	84.4
% AS	13.0	7.5	4.2	4.2	6.4	5.7	11.6	6.3	11.3	5.5	6.0	4.7	5.6	5.6	15.6

a - preliminary
b also 4475 age 0 SS
c also 10 age 0 SS

Table 9 Commercial catch at age of spring and autumn spawning herring for Bonavista Bay-Trinity Bay, 1970-1999

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	1	1	1	1	1	1	5	10	1	1	1	1	1	1	1
2	1	1	1	1	1	1	14	16	22	6	15	130	1	1	4
3	1	690	10	1	1	392	77	248	26	286	13	246	8	4	22
4	1	311	1347	60	2	134	493	135	357	167	195	53	11	34	35
5	9	192	389	4887	235	163	123	759	122	765	43	256	2	7	210
6	55	84	91	126	4795	2564	166	227	251	19	293	26	30	2	9
7	808	361	75	96	424	14330	4897	50	112	436	52	288	5	15	5
8	35	1373	88	1	151	455	20997	6209	598	101	264	23	35	1	12
9	126	151	480	48	294	995	909	23206	4412	530	75	321	5	8	2
10	69	126	14	271	69	727	854	774	13394	5575	967	88	65	2	2
11+	212	522	213	1	1849	1679	4306	5890	5956	19994	12259	11762	1186	159	154
Total	1316	3702	2769	5493	7822	21441	32541	37524	25251	27889	14177	13200	1349	234	456

Age	b 1985	1986	c 1987	1988	1989	1990	1991	1992	1993	1994	a 1995	a 1996	a 1997	a 1998	a 1999
1	1	151	296	717	1	1	115	1	1	1	4	1	1	1	1
2	13	207	1352	6612	563	58	689	499	354	1	1	1	75	54	50
3	175	443	413	9910	1043	3094	210	1056	621	394	107	23	302	524	48
4	70	4445	2645	267	3323	422	13551	271	160	819	2645	63	13	543	922
5	87	261	10208	3674	264	2350	2586	12612	344	303	349	2638	96	170	644
6	351	161	334	21739	1428	94	3859	2422	3779	1072	64	345	3230	128	11
7	37	252	359	782	8639	629	347	579	422	3878	152	46	182	1322	14
8	27	38	126	713	13	4439	1550	194	385	479	978	157	7	94	3175
9	13	19	33	8	216	235	7505	1394	132	471	172	430	1	4	922
10	22	31	6	55	100	325	447	2054	657	530	163	11	29	4	62
11+	797	657	656	1247	508	466	891	653	1092	2614	649	300	94	87	144
Total	1593	6666	22928	45724	16098	12113	31750	21735	7947	10562	5284	4015	4030	2931	5993

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	10	1	1	1	14	5	3	1	1
4	9	1	1	1	1	26	22	55	16	1	11	115	1	10	3
5	1	10	1	1	1	30	77	16	14	27	17	106	8	2	64
6	1	1	1	1	1	1	23	176	61	114	82	33	10	5	14
7	4	4	2	1	16	22	66	86	58	30	188	83	3	2	17
8	17	23	2	48	2	41	34	112	28	175	45	283	5	1	3
9	18	3	5	1	1	6	62	30	23	13	112	35	25	1	5
10	17	21	1	1	1	19	8	73	62	16	2	4	1	1	1
11+	730	406	33	1	1216	259	1069	1069	417	800	483	230	37	3	9
Total	805	472	49	58	1242	407	1373	1620	702	1179	958	898	95	26	139

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	a 1995	a 1996	a 1997	a 1998	a 1999
1	1	1	19	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	253	1	1	1	1	1	1	13	1	1	1	22
3	1	1	1	54	1	5	6	1	11	1	6	1	33	1	58
4	5	51	2	22	55	139	140	10	1	1	39	1	63	261	64
5	18	89	391	88	75	55	837	219	146	53	90	119	26	270	185
6	203	50	237	357	136	9	152	205	205	168	4	126	88	118	297
7	96	292	87	216	237	61	17	118	163	27	1	16	39	134	42
8	54	140	360	202	18	50	99	1	121	114	48	29	3	75	56
9	22	24	138	818	83	58	104	5	39	1	24	11	6	2	61
10	16	1	2	2	897	19	125	1	14	1	1	1	19	33	98
11+	29	30	156	237	193	89	481	167	376	79	206	20	4	16	20
Total	440	683	1394	2250	1498	487	1963	729	1078	446	433	326	283	912	904

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total	2126	4174	2758	5551	9064	21848	33914	39144	25953	29059	15115	471	3318	2127	2127
% SS	62.0	88.7	98.2	98.0	86.3	98.1	96.0	95.9	97.3	95.9	93.8	73.2	97.3	0.0	0.0
% AS	38.0	11.3	1.8	1.0	13.7	1.9	4.0	4.1	2.7	4.1	6.2	26.8	2.7	100.0	100.0

	b 1985	1986	c 1987	1988	1989	1990	1991	1992	1993	1994	a 1995	a 1996	a 1997	a 1998	a 1999
Total	2033	7355	24322	47974	17596	12600	33713	22464	9025	11008	5717	4341	4313	3843	6897
% SS	78.4	90.6	94.3	95.3	91.5	96.1	94.2	96.8	88.1	95.9	92.4	92.5	93.4	76.3	86.9
% AS	21.6	9.4	5.7	4.7	8.5	3.9	5.8	3.2	11.9	4.1	7.6	7.5	6.6	23.7	13.1

a preliminary
b also 10 age 0 SS
c also 3124 age 0 SS

Table 10 Commercial catch at age of spring and autumn spawning herring for St. Mary's Bay - Placentia Bay, 1970-1999.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	3	1	1	1	3	1	1	1	1	1	1	1	1	1	1
2	476	1	1	76	995	74	365	52	30	87	133	1	1	1	8
3	103	557	207	326	280	2234	391	1423	175	663	332	193	1	5	9
4	4434	116	20375	77	234	471	1906	140	1817	279	133	42	2	2	24
5	59	2111	725	15470	126	147	208	736	123	2263	153	111	3	3	36
6	76	80	5154	566	14328	1591	267	87	596	96	1270	51	8	2	6
7	645	251	365	6757	436	13858	862	50	64	614	57	338	3	4	3
8	66	45	650	93	6049	146	5622	1039	106	85	470	28	14	1	24
9	72	13	352	224	138	3391	201	3830	512	66	38	80	4	9	1
10	37	22	73	193	238	350	2256	134	3827	501	237	6	4	1	10
11+	102	56	403	315	624	1323	1361	2448	2185	4785	2971	466	69	39	44
Total	6084	3293	28306	24098	23451	23586	13440	9940	9436	9440	5795	1317	110	68	166

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
1	1	1	1	1	1	1	1	1	1	13	1	1	1	1	1
2	1	1	34	1	22	1	37	68	5	24	1	19	235	151	1
3	2	1	19	1	48	115	1	47	62	137	333	19	125	486	21
4	16	143	2	22	9	189	222	7	34	5	1418	224	1	205	21
5	27	19	502	163	1	54	160	363	11	36	37	1187	1656	61	1
6	21	26	29	2457	24	15	170	231	187	6	1	94	8237	872	1
7	15	9	47	119	463	30	12	55	118	225	1	43	465	3213	84
8	5	4	9	213	34	494	110	53	74	60	63	32	134	299	293
9	25	1	3	16	100	45	493	74	63	98	1	51	76	185	42
10	5	5	1	36	5	172	88	383	56	172	16	16	50	43	21
11+	125	30	11	147	34	128	948	965	1174	1042	416	177	280	109	63
Total	248	240	658	3176	741	1254	2242	2247	1785	1818	2288	1863	11260	5625	549

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	24	5	2	1	11	1	1	1	1	1	1	1	1
4	1	9	61	150	2	7	4	47	23	11	99	139	1	18	17
5	2	2	175	52	96	58	214	52	435	143	35	116	7	6	101
6	1	53	15	71	146	182	67	209	92	598	52	10	1	12	32
7	71	31	61	10	80	89	32	81	244	73	419	11	1	4	21
8	112	41	37	54	95	206	17	69	122	216	79	50	1	1	5
9	15	84	101	17	93	6	94	26	38	21	126	7	1	1	3
10	28	35	71	68	51	37	11	22	52	2	25	1	1	1	1
11+	202	314	539	737	970	677	329	526	561	348	492	29	2	4	8
Total	439	574	1086	1166	1537	1275	781	1035	1570	1415	1327	365	16	50	191

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	4	1	5	7	1	1	1	7	1	19	76	61	1
4	9	16	12	20	5	37	14	7	2	7	105	40	295	231	1
5	20	24	32	30	18	61	87	8	208	62	112	82	188	444	1
6	86	15	80	239	8	54	40	50	239	116	35	102	1231	273	42
7	46	97	30	90	56	24	23	33	173	182	106	10	1361	762	63
8	36	28	82	35	43	47	65	27	41	231	99	19	229	694	105
9	10	16	24	270	67	58	98	64	41	182	87	9	306	375	63
10	3	4	3	5	178	17	40	1	3	1	78	1	50	23	105
11+	24	15	12	63	164	173	495	479	863	411	282	74	730	255	125
Total	237	218	282	745	546	480	865	672	1573	1201	907	358	4468	3121	508

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total	6523	3867	29392	25264	24988	24861	14221	10975	11006	10855	7122	196	9468	1145	43
% SS	93.3	85.2	96.3	95.4	93.8	94.9	94.5	90.6	85.7	87.0	81.4	48.0	87.0	76.2	2.3
% AS	6.7	14.8	3.7	4.6	6.2	5.1	5.5	9.4	14.3	13.0	18.6	52.0	13.0	23.8	97.7

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
Total	485	460	940	3921	1287	1734	3107	2919	3358	3019	3195	2221	15728	8746	1057
% SS	51.1	52.6	70.0	81.0	57.6	72.3	72.2	77.0	53.2	60.2	71.6	83.9	71.6	64.3	51.9
% AS	48.9	47.4	30.0	19.0	42.4	27.7	27.8	23.0	46.8	39.8	28.4	16.1	28.4	35.7	48.1

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Table 11. Commercial catch at age of spring and autumn spawning herring for Fortune Bay, 1970 - 1999

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	1	1	617	23	1	1	1	1	1	1	1	1	1	1	1
2	29475	167	1515	2210	389	2	82	27	1	1	25	1	1	1	2
3	5988	23223	256	925	1314	277	15	2103	42	1	16	144	1	2	1
4	11953	6086	19690	67	552	581	318	25	2677	183	3	16	5	2	4
5	149	23525	2896	5694	130	112	228	327	62	3833	69	4	3	1	3
6	281	1165	10767	475	4435	87	129	166	237	15	1122	3	1	1	2
7	7894	5747	351	1712	250	1490	11	26	43	165	7	21	2	1	1
8	213	3514	4432	73	1094	16	338	43	139	5	183	2	36	1	2
9	16	132	991	282	36	142	36	168	52	24	1	23	1	10	1
10	225	148	34	558	117	22	188	4	326	1	11	1	5	1	2
11+	297	537	366	173	255	201	140	244	302	167	50	12	5	18	23
Total	56456	64245	41915	12192	8573	2931	1486	3154	3882	4396	1488	228	59	39	42

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	54	1	1	1	1	1	1	1	2	6	1	1	1	1	108
4	3	145	1	1	1	1	23	1	1	1	1	201	1	1	27
5	39	4	304	1	1	2	8	3	1	2	14	12	1	1	1
6	12	69	11	219	18	2	1	1	327	1	14	17	1	1	48
7	2	20	49	7	274	12	1	1	2	24	24	1	1	1	316
8	1	6	18	26	1	155	6	1	3	9	569	1	1	1	152
9	1	1	4	6	17	17	274	2	8	23	36	47	1	1	120
10	1	2	1	1	11	20	1	75	10	5	36	6	15	1	1
11+	15	14	38	10	24	1	72	266	217	647	728	38	355	1	477
Total	130	264	429	274	350	213	389	353	573	723	1425	326	379	11	1752

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	7	1	7	1	1	1	1	5	1	1	1
4	1	598	1	48	9	22	9	23	1	7	4	64	1	1	1
5	334	1	84	50	87	12	38	19	36	5	3	16	7	1	9
6	1	136	25	79	65	39	26	19	6	50	3	1	2	2	4
7	443	175	185	8	12	19	13	1	25	1	3	1	1	1	6
8	816	769	44	32	27	20	1	1	12	17	1	1	1	1	1
9	412	626	310	15	5	11	27	1	6	12	1	1	1	1	1
10	1	470	125	27	1	7	1	1	1	1	1	1	1	1	1
11+	2261	1956	793	97	85	45	9	2	18	12	1	1	1	1	1
Total	4212	4734	1570	359	300	178	133	70	108	108	20	93	18	12	27

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	17	3	1	2	3	10	1	1	1	1	1	1	1	1	1
5	4	8	4	1	6	5	1	4	1	1	1	1	1	1	1
6	26	16	7	5	1	12	8	5	3	1	1	1	1	1	1
7	12	34	11	5	6	17	1	3	11	1	26	1	1	1	27
8	7	12	25	1	31	7	3	1	1	1	31	1	1	1	1
9	4	5	16	13	3	54	1	1	1	1	10	2	1	1	1
10	1	1	5	1	17	1	3	1	1	1	1	1	1	1	1
11+	2	5	14	10	5	5	1	5	26	14	1	1	1	1	2
Total	76	91	90	41	75	114	22	24	48	24	74	12	11	11	38

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total	60668	68979	43485	12551	8873	3109	1619	3224	3990	4504	1508	321	2	51	69
% SS	93.1	93.1	96.4	97.1	96.6	94.3	91.8	97.8	97.3	97.6	98.7	71.0	50.0	75.6	60.9
% AS	6.9	6.9	3.6	2.9	3.4	5.7	8.2	2.2	2.7	2.4	1.3	29.0	50.0	23.5	39.1

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 a	1996 a	1997 a	1998 a	1999 a
Total	206	355	509	315	425	327	411	377	621	747	1499	338	390	22	1790
% SS	63.1	74.4	84.3	87.0	82.4	65.1	94.6	93.6	92.3	96.8	95.1	96.4	97.2	50.0	97.9
% AS	36.9	25.6	15.7	13.0	17.6	34.9	5.4	6.4	7.7	3.2	4.9	3.6	2.8	50.0	2.1

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Table 12. Mean weights at age (g) of spring-spawning herring, by stock area, from samples collected January to June, 1994 – 1999. Sample sizes are in parenthesis.

Stock Area	Age	1994	1995	1996	1997	1998	1999
WB-NDB	0	- -	- -	- -	- -	- -	- -
	1	- -	- -	- -	- -	- -	- -
	2	- -	- -	- -	- -	- -	- -
	3	74 (6)	125 (1)	- -	106 (8)	112 (33)	- -
	4	132 (724)	131 (15)	154 (1)	- -	147 (375)	155 (277)
	5	187 (65)	166 (332)	167 (124)	230 (1)	170 (1)	176 (363)
	6	210 (353)	200 (16)	201 (703)	192 (175)	201 (3)	216 (5)
	7	238 (697)	226 (85)	239 (31)	223 (332)	227 (42)	245 (3)
	8	271 (37)	249 (204)	254 (62)	250 (25)	237 (160)	254 (58)
	9	283 (37)	286 (13)	274 (198)	259 (48)	248 (5)	259 (85)
	10	304 (39)	288 (15)	289 (12)	292 (80)	283 (21)	294 (12)
	11+	330 (252)	324 (53)	371 (49)	354 (93)	363 (185)	340 (78)
BB-TB	0	- -	- -	- -	- -	- -	- -
	1	- -	- -	- -	- -	- -	- -
	2	- -	- -	- -	- -	- -	- -
	3	181 (20)	101 (3)	- -	115 (13)	143 (12)	168 (1)
	4	144 (265)	133 (354)	161 (7)	- -	172 (60)	187 (262)
	5	198 (105)	172 (103)	189 (827)	203 (19)	219 (2)	207 (108)
	6	224 (192)	218 (31)	215 (127)	214 (1044)	238 (18)	234 (6)
	7	255 (941)	237 (62)	258 (31)	235 (128)	245 (746)	246 (12)
	8	295 (122)	270 (240)	271 (40)	272 (36)	254 (59)	275 (574)
	9	308 (207)	291 (32)	280 (135)	287 (33)	256 (2)	282 (26)
	10	306 (158)	289 (43)	308 (20)	301 (91	293 (16)	287 (4)
	11+	345 (966)	331 (272)	345 (194)	341 (179)	339 (74)	340 (34)
SMB-PB	0	- -	- -	- -	- -	- -	- -
	1	- -	- -	- -	- -	- -	- -
	2	59 (28)	- -	- -	71 (4)	79 (7)	157 (4)
	3	115 (260)	107 (87)	- -	122 (19)	130 (161)	143 (266)
	4	168 (108)	171 (386)	170 (179)	112 (1)	178 (37)	175 (72)
	5	219 (59)	229 (29)	224 (499)	211 (134)	205 (4)	198 (27)
	6	249 (16)	264 (4)	270 (34)	251 (562)	258 (37)	- -
	7	291 (150)	278 (10)	301 (16)	278 (64)	286 (376)	264 (50)
	8	322 (40)	324 (40)	353 (4)	312 (16)	300 (57)	309 (147)
	9	332 (95)	347 (10)	349 (21)	317 (8)	328 (14)	298 (17)
	10	330 (60)	334 (12)	388 (2)	331 (4)	326 (7)	322 (8)
	11+	384 (511)	381 (122)	426 (97)	413 (126)	424 (68)	394 (57)
FB	0	- -	- -	- -	- -	- -	- -
	1	- -	23 (2)	- -	- -	- -	- -
	2	- -	- -	- -	- -	- -	79 (2)
	3	114 (5)	90 (96)	- -	121 (7)	99 (1)	103 (787)
	4	157 (68)	150 (99)	167 (61)	168 (4)	186 (2)	152 (38)
	5	195 (13)	185 (162)	205 (89)	190 (274)	- -	185 (23)
	6	214 (28)	218 (17)	237 (77)	226 (152)	227 (302)	217 (18)
	7	257 (242)	237 (31)	256 (8)	262 (90)	250 (71)	249 (285)
	8	279 (17)	265 (212)	292 (12)	285 (12)	281 (90)	279 (113)
	9	294 (8)	311 (19)	309 (150)	287 (14)	292 (11)	303 (37)
	10	320 (11)	311 (9)	337 (16)	317 (66)	320 (13)	323 (17)
	11+	362 (366)	359 (252)	391 (257)	384 (326)	360 (185)	373 (242)

Table 10. Spring recruitment (pre-fishery rates at age (numbers per days fished - spring spawners only - by stock area and year.

Area 3 - Notre Dame Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2							0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3							5.6	2.3	4.6	2.9	5.3	2.6	0.7	0.8	2.0	2.8	1.2	2.1	
4							0.3	21.8	9.2	50.1	1.2	1.7	16.6	34.3	0.3	0.0	5.7	17.6	
5							2.3	0.9	27.7	12.0	46.2	4.2	3.6	9.0	140.9	0.3	0.2	7.2	
6							29.2	9.5	4.6	27.5	8.1	50.6	12.6	1.7	20.5	181.9	1.7	0.4	
7							0.5	57.7	13.2	3.2	10.3	6.4	65.0	4.6	5.3	23.7	62.3	2.5	
8							0.4	0.9	63.8	19.8	2.3	7.0	8.5	19.9	5.5	5.6	4.6	29.8	
9							0.6	0.6	0.8	62.3	17.6	3.7	5.9	2.6	20.5	7.0	2.1	1.4	
10							0.0	0.7	3.2	3.6	24.8	12.1	7.3	3.1	3.7	16.7	1.3	0.8	
11+							12.2	8.6	6.9	8.3	16.8	20.2	40.1	25.0	31.4	38.2	5.5	2.3	
Total							51.2	80.1	135.1	189.2	137.6	113.5	167.6	99.2	229.1	278.9	83.5	69.9	42.0

Bonavista Bay - Trinity Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2							0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
3							5.6	2.3	4.6	2.9	5.3	2.6	0.7	0.8	2.0	2.8	1.2	2.1	
4							0.3	21.8	9.2	50.1	1.2	1.7	16.6	34.3	0.3	0.0	5.7	17.6	
5							2.3	0.9	27.7	12.0	46.2	4.2	3.6	9.0	140.9	0.3	0.2	7.2	
6							29.2	9.5	4.6	27.5	8.1	50.6	12.6	1.7	20.5	181.9	1.7	0.4	
7							0.5	57.7	13.2	3.2	10.3	6.4	65.0	4.6	5.3	23.7	62.3	2.5	
8							0.4	0.9	63.8	19.8	2.3	7.0	8.5	19.9	5.5	5.6	4.6	29.8	
9							0.6	0.6	0.8	62.3	17.6	3.7	5.9	2.6	20.5	7.0	2.1	1.4	
10							0.0	0.7	3.2	3.6	24.8	12.1	7.3	3.1	3.7	16.7	1.3	0.8	
11+							12.2	8.6	6.9	8.3	16.8	20.2	40.1	25.0	31.4	38.2	5.5	2.3	
Total							51.2	80.1	135.1	189.2	137.6	113.5	167.6	99.2	229.1	278.9	83.5	69.9	42.0

St. Mary's Bay - Placentia Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.2	1.5	0.7	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.6	1.1	
3	0.2	10.2	18.6	59.3	0.3	13.7	2.3	23.5	11.2	0.8	2.7	3.5	15.6	11.3	0.0	4.1	22.6	67.7	
4	0.6	1.5	21.9	5.8	125.6	1.7	4.2	6.0	19.5	16.5	0.7	3.3	25.4	49.2	54.9	0.3	5.5	21.4	
5	0.4	0.9	7.0	9.9	5.5	152.1	2.7	1.8	0.7	7.1	21.8	1.5	2.9	1.9	159.8	20.4	0.3	8.0	
6	1.4	1.0	2.7	6.9	17.4	11.6	100.2	3.5	2.4	1.9	3.8	12.1	0.4	0.4	5.3	66.7	10.1	0.0	
7	0.2	3.2	0.5	2.4	3.4	17.7	0.2	64.3	5.0	0.5	2.4	2.4	6.9	0.8	5.9	12.6	26.2	13.0	
8	1.7	0.4	7.3	2.1	2.6	4.0	14.4	3.3	59.9	1.1	1.0	2.7	2.1	1.8	1.9	2.4	4.4	31.2	
9	0.4	4.7	0.3	8.6	0.1	2.1	2.0	12.6	2.4	8.3	1.6	1.1	3.6	1.2	5.9	2.2	1.3	4.4	
10	0.4	0.5	10.1	2.7	2.4	0.6	0.1	3.1	16.7	1.1	7.5	2.1	3.2	0.3	0.8	3.5	1.0	2.1	
11+	5.5	19.4	47.0	45.4	12.1	7.4	7.2	4.6	9.8	4.8	12.1	17.2	45.6	3.9	29.0	28.9	7.9	10.1	
Total	11.0	43.3	116.3	143.1	172.5	210.7	140.7	123.7	139.5	42.3	54.0	46.2	108.9	70.3	266.3	135.8	79.8	164.2	154.6

Fortune Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.9	0.4	0.0	14.3	0.0	0.0	0.0	12.1	28.8	0.6	0.3	0.0	1.5	0.0	0.0	0.0	2.4	82.8	
4	0.6	0.0	22.1	2.8	234.0	0.0	0.0	2.6	1.4	54.4	3.6	0.0	32.1	22.6	13.0	0.0	2.1	36.1	
5	1.6	3.6	15.0	204.5	8.5	512.2	1.1	0.1	0.3	1.4	61.3	9.1	14.0	35.4	134.5	89.2	0.2	21.5	
6	0.1	3.3	6.1	69.2	89.5	11.7	420.7	15.8	0.0	2.2	11.5	140.4	21.4	6.9	112.1	193.1	314.2	15.4	
7	0.2	2.4	1.4	15.7	15.3	48.3	9.8	659.3	6.2	1.7	1.8	5.0	252.5	19.6	12.1	103.9	144.5	245.8	
8	0.0	2.1	4.1	4.6	13.0	20.7	50.6	14.8	236.8	21.9	1.7	3.7	3.3	258.4	19.0	19.6	161.8	161.3	
9	0.2	44.6	0.2	6.9	0.6	4.8	11.4	64.9	19.7	263.8	6.3	0.0	12.0	39.0	187.1	17.6	19.6	40.1	
10	0.7	4.5	4.4	6.5	2.0	1.4	2.1	30.4	59.0	38.1	70.3	9.5	12.0	12.3	19.0	104.9	28.2	21.3	
11+	0.8	53.7	102.5	135.3	35.9	71.8	19.6	124.3	56.1	141.4	175.0	245.3	319.3	137.2	350.4	451.8	350.2	230.4	
Total	10.3	128.7	155.8	581.6	599.3	681.2	516.8	927.3	479.4	560.9	351.4	413.0	668.0	693.5	662.3	980.0	1024.3	855.5	799.5

Table 13. Spring research gillnet catch rates at age (numbers per days fished), spring spawners only, by stock area and year

White Bay - Notre Dame Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3							4.7	15.0	83.5	11.0	0.0	1.2	0.6	0.0	0.0	2.2	7.9	6.5	
4							1.9	43.3	51.6	247.1	21.5	10.9	232.0	18.5	0.9	0.6	117.6	70.3	
5							22.2	11.2	52.9	28.8	493.7	51.0	14.5	300.1	47.9	3.2	1.2	85.1	
6							59.5	126.6	16.3	12.7	33.5	359.9	52.1	22.2	236.0	77.1	1.2	1.2	
7							5.6	182.9	144.6	7.5	12.7	19.8	182.7	45.9	12.7	139.5	12.9	2.4	
8							4.7	9.7	190.5	84.2	10.3	6.7	14.1	104.1	21.9	8.6	43.3	9.5	
9							12.0	18.0	11.5	164.3	47.2	13.4	7.6	9.4	74.2	17.8	1.7	15.0	
10							1.8	24.3	26.5	21.9	127.9	29.7	12.9	9.5	5.2	31.0	6.9	2.5	
11+							34.1	56.4	97.1	106.1	110.8	115.9	69.1	52.1	21.1	39.4	56.8	15.0	
Total							146.4	486.4	676.8	684.6	858.6	606.9	585.7	559.8	455.5	320.0	248.0	202.1	54.3

Bonavista Bay - Trinity Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2							0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3							5.5	2.3	8.6	0.9	0.3	2.6	0.7	0.0	0.0	2.8	1.2	0.1	
4							0.3	21.8	8.2	50.1	1.2	1.7	16.6	34.3	0.9	0.0	5.7	17.6	
5							2.3	0.9	27.7	12.0	46.2	8.2	9.6	9.0	140.9	3.3	0.2	7.2	
6							29.2	5.5	4.5	27.9	8.1	50.6	12.6	1.7	20.8	181.9	1.7	0.4	
7							0.5	57.7	12.2	3.2	10.3	6.4	65.0	4.6	5.3	23.7	62.3	0.6	
8							0.4	0.9	50.8	19.8	2.3	7.0	6.5	19.9	5.5	5.6	4.6	29.8	
9							0.6	0.6	0.8	62.3	17.6	3.7	8.9	2.6	20.8	7.0	2.1	1.4	
10							0.0	0.7	3.2	3.8	34.8	13.1	7.5	3.0	3.7	16.7	1.3	0.3	
11+							12.2	5.5	8.5	8.3	16.8	20.2	40.1	25.0	31.4	38.2	5.5	2.3	
Total							51.2	96.1	135.1	188.2	137.6	113.5	167.6	99.2	229.1	278.9	83.0	59.9	42.0

St. Mary's Bay - Placentia Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.2	1.5	0.7	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.6	1.1	
3	0.2	10.2	18.6	59.3	0.3	13.7	2.3	23.5	11.2	0.9	2.7	3.5	15.6	11.3	0.0	4.1	22.6	67.7	
4	0.6	1.8	21.9	5.9	125.6	1.7	4.2	6.0	19.5	16.5	0.7	3.3	25.4	49.2	54.9	0.3	5.5	21.4	
5	0.4	0.9	7.0	9.9	8.5	152.1	2.7	1.8	5.7	7.1	21.8	1.5	2.9	1.8	159.8	20.4	0.3	8.0	
6	1.4	1.0	2.7	6.9	17.4	11.6	100.2	3.5	2.4	1.9	3.8	12.1	0.4	0.4	9.3	66.7	10.1	0.0	
7	0.2	3.2	0.9	2.4	3.4	17.7	6.2	64.3	5.0	0.5	2.4	2.4	6.9	0.8	5.9	12.6	26.2	13.0	
8	1.7	0.4	7.3	2.1	2.6	4.0	14.4	3.3	69.9	1.1	1.0	2.7	2.1	1.8	1.9	2.4	4.4	31.2	
9	0.4	4.7	0.2	8.6	0.1	2.1	3.0	12.6	2.4	8.3	1.6	1.1	3.8	1.2	5.9	2.2	1.3	4.4	
10	0.4	0.5	10.1	2.7	2.4	0.6	0.1	3.1	16.7	1.1	7.5	2.1	3.2	0.3	0.8	0.5	1.0	2.1	
11+	6.5	19.4	47.0	45.4	12.1	7.4	7.2	4.9	6.8	4.8	12.1	17.2	45.6	3.5	28.0	26.9	7.9	15.1	
Total	11.9	43.8	116.3	143.1	172.5	210.7	140.7	123.2	139.5	42.3	54.8	46.2	105.9	70.3	266.3	135.8	79.8	164.3	154.6

Fortune Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.6	8.4	0.0	14.3	0.0	0.0	0.0	12.1	98.8	0.6	0.3	0.0	1.3	0.0	0.0	0.0	2.4	82.8	
4	0.8	6.0	22.1	2.8	224.0	0.0	0.0	0.9	1.4	54.4	3.6	0.0	32.1	22.6	19.0	0.0	3.7	36.7	
5	0.6	3.9	15.0	204.5	8.8	532.2	3.1	0.9	0.0	16.8	61.3	9.1	14.0	85.4	134.5	89.2	0.0	21.3	
6	0.1	3.1	6.1	69.2	69.9	11.7	420.7	15.8	0.0	2.2	11.6	140.4	21.4	8.9	112.1	193.1	514.2	15.4	
7	0.2	2.4	1.4	15.7	45.3	48.3	9.8	659.3	6.2	1.7	1.3	5.0	252.5	19.6	12.1	103.9	144.5	245.9	
8	6.0	2.7	4.1	4.6	10.0	20.7	50.6	14.8	236.8	21.9	1.7	3.7	3.3	258.4	19.0	19.6	161.6	161.3	
9	0.3	44.0	0.3	8.8	0.8	4.8	11.4	64.9	19.7	283.8	6.3	0.0	12.0	39.0	187.1	17.6	19.6	40.1	
10	0.8	4.6	4.4	6.5	2.0	1.4	2.1	33.4	59.0	38.1	70.3	9.5	12.0	12.3	19.0	104.9	28.2	21.3	
11+	0.8	53.7	102.5	135.3	35.9	71.8	19.6	124.3	56.1	141.4	175.0	245.3	319.3	237.2	360.4	451.8	350.2	230.4	
Total	10.3	128.7	156.0	461.6	399.3	690.2	516.8	927.3	479.4	560.9	331.4	413.0	668.0	683.6	862.3	980.0	1224.3	853.5	708.9

Table 14. Biological sampling details of herring, Andrew and Nicholas Trip #3, White Bay - Notre Dame Bay, November - December, 1998.

Stratum	Survey Date(s)	Sample Date	Sample Location	Gear Type	Sample #'s	n	Mean Lgt. (mm)	Mean Wgt. (g)
23B	Nov. 11 - 14	Nov. 11	Shoal Bay	Comm. PS	258, 259	100	298	242
		Nov. 13	Island Harbour	Res. PS	211, 212	100	283	198
22	Nov. 14 - 15	Nov. 15	Twillingate	Res. PS	213, 214	100	282	188
18	Nov. 18 - 22	Nov. 18	Hornet Gut	Res. PS	241, 242	100	279	183
		Nov. 22	Thwart Island	Res. PS	248, 249	100	240	121
17	Nov. 20 - 22	Nov. 21	Botwood Run	Res. PS	243, 244	100	108	10
		Nov. 21	Botwood Run	Res. PS	246, 247	100	279	189
16	Nov. 23 - 28	Nov. 23	Cottles Cove	Res. PS	252, 253	100	250	141
		Nov. 23	Beson Cove	Res. PS	250, 251	100	259	160
12	Nov. 29 - 30	Nov. 30	Robert's Arm	Res. PS	254, 255	100	141	24
10	Dec. 1 - 2	Dec. 2	Southern Arm	Res. PS	256, 257	100	286	200
9	Dec. 2 - 3	Dec. 3	King's Point	Res. PS	261, 262	100	194	66

Table 15. Mean lengths and weights, by stratum, used to calculate target strengths for 1998 White Bay - Notre Dame Bay acoustic survey.

Stratum	Combined Samples	Mean Lgt. (mm)	Mean Wgt. (g)	TS / fish (dB)	TS / g
23A, 23B	211, 212, 258, 259	290	220	-36.25	-59.68
22, 21	213, 214	282	188	-36.50	-59.24
18-1	241, 242	279	183	-36.59	-59.21
18-2	248, 249	240	121	-37.90	-58.72
17-1	243, 244	108	10	-44.83	-54.83
17-2	246, 247	279	189	-36.59	-59.35
16, 14	250, 251, 252, 253	255	150	-37.37	-59.13
12	254, 255	141	24	-42.52	-56.32
10	256, 257	286	200	-36.37	-59.38
9	261, 262	194	66	-39.74	-57.94

Table 16. White Bay - Notre Dame Bay herring biomass estimate from the 1998 acoustic survey.

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
23D	2.27E+08	26	0.20						
		27	4.21						
		28	4.54						
		29	4.43						
		30	3.81						
		31	4.20	1	1.212	3.2190	3.9018		
		32	5.02						
		33	4.59						
		34	3.46						
		35	3.09						
		36	2.97						
		37	2.98	2	1.186	9.9387	11.7846		
		38	0.35						
		39	2.51						
		40	2.82						
		41	2.95						
		42	3.20						
		43	3.25	3	0.854	0.0000	0.0000		
		44	3.27						
		45	3.73						
		46	3.81						
		47	3.42						
		48	2.50						
		49	1.99	4	1.061	10.2328	10.8500		
		50	1.82						
		51	2.17						
		52	2.66						
		53	2.78						
		54	2.84						
		55	2.45	5	0.840	0.0000	0.0000		
		56	2.29						
		57	2.71						
		58	1.86						
		59	3.71						
		60	3.33						
		61	1.07	6	0.848	6.3294	5.3678	5.3174	1207
23A	5.00E+08	14	2.38						
		15	4.41						
		16	4.00						
		17	6.00	1	0.360	0.0131	0.0124		
		18	5.30						
		19	5.13						
		20	4.80						
		21	4.85	2	1.147	0.0000	0.0000		
		22	4.89						
		23	5.12						
		24	5.02						
		25	1.83	3	0.909	0.0000	0.0000	0.0041	2
23	3.67E+08	62	5.29						
		63	5.09						
		64	4.62						
		65	5.40	1	1.300	6.9644	9.0566		
		66	5.13						
		67	4.81						
		68	4.54						
		69	3.36	2	1.139	0.0000	0.0000		
		70	1.88						
		71	2.00						
		72	2.89						
		73	2.00	3	0.660	4.6933	2.6286	3.8952	1430
23	1.04E+09	74	2.08						
		75	1.30						
		371	5.57						
		372	4.55						
		373	1.29	1	1.341	5.7407	7.7011		
		76	0.48						
		77	1.22						
		374	1.39						
		375	1.11						
		376	3.07	2	0.659	0.0000	0.0000	3.8506	631

Table 16(cont.). White Bay - Notre Dame Bay herring biomass estimate from the 1998 acoustic survey.

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
14	2.43E+08	86	1.90						
		87	2.58						
		88	2.88						
		89	1.92						
		90	2.37						
		389	2.04	1	0.772	26.6219	20.7126		
		91	3.25						
		92	4.15						
		93	5.90						
		94	3.43						
		95	3.05						
		390	3.07	2	1.315	8.3935	10.9937		
		96	5.43						
		97	4.13						
		98	2.76						
		99	2.94						
		100	2.29						
		391	3.35	3	1.252	2.7117	3.3952		
		101	3.32						
		102	1.61						
		103	1.44						
		104	1.72						
		105	1.80						
		392	1.14	4	0.681	0.0000	0.0000	8.7752	2132
17	1.29E+09	106	1.00						
		107	3.25						
		108	2.57						
		109	2.19						
		110	1.33						
		111	0.17						
		112	1.74						
		393	1.38						
		394	2.23	1	1.931	33.0542	44.5086		
		113	2.58						
		114	2.23						
		115	1.57						
		116	1.42						
		117	0.96						
		118	0.16						
		119	0.30						
		395	2.60						
		396	1.24	2	1.597	130.3266	208.1450		
		120	0.65						
		121	0.48						
		122	0.25						
		123	0.50						
		124	0.77						
		125	1.08						
		126	1.17						
		397	0.50						
		398	0.20	3	0.683	0.0000	0.0000		
		127	1.17						
		128	0.81						
		129	0.58						
		130	0.75						
		131	0.07						
		132	0.38						
		133	0.58						
		399	1.16						
		401	0.76	4	0.702	0.0000	0.0000		
		134	0.35						
		135	0.54						
		136	0.70						
		137	1.50						
		138	0.20						
		139	0.39						
		140	0.08						
		402	0.90						
		403	3.56	5	0.599	1.5715	0.9412		
		141	0.24						
		142	0.65						
		143	1.10						
		144	0.52						
		404	0.23						
		405	0.78	6	0.426	0.0000	0.0000	42.2668	5263

Table 16(cont.'). White Bay - Notre Dame Bay herring biomass estimate from the 1998 acoustic survey.

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
10	1.13E+08	145	0.57						
		146	0.73						
		147	0.93						
		148	2.27						
		149	2.93						
		407	2.25						
		408	1.88	1	1.648	26.1533	43.0918		
		150	2.47						
		151	2.38						
		152	1.62						
		153	1.57						
		154	1.93						
		409	1.49						
		410	1.59	2	1.867	8.7580	16.3526		
		155	2.59						
		156	2.27						
		157	1.75						
		158	1.10						
		159	0.42						
		411	1.63						
		412	0.58	3	1.486	25.2287	37.4691		
		160							
		161							
		162							
		163							
		164							
		413							
		414		4	0.000	0.0000	0.0000		
		165							
		166							
		167							
		168							
		169							
		415							
		416		5	0.000	0.0000	0.0000	19.3827	2906
14	5.50E+07	174	3.92						
		175	2.42						
		425							
		426	0.19						
		427	2.28						
		428	1.92	1	1.503	0.6536	0.9822		
		176	0.53						
		177	0.23						
		429	1.24						
		430	0.62						
		431	0.80						
		432	0.13	2	0.497	0.0000	0.0000	0.4811	27
10	8.80E+07	230							
		231							
		232							
		233							
		234	0.10	1	0.015	0.0000	0.0000		
		235	0.59						
		236	0.85						
		237	1.14						
		238	2.42						
		239	2.17	2	1.061	159.5732	169.3931		
		240	1.99						
		241	2.47						
		242	2.76						
		243	3.73						
		244	1.81	3	1.869	0.0000	0.0000		
		245	2.63						
		246	2.26						
		247	1.21						
		248	0.39						
		249		4	1.035	0.0000	0.0000	42.3458	3726

Table 16(cont.) White Bay - Notre Dame Bay herring biomass estimate from the 1998 acoustic survey.

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
1	4,48,497	241	0.36						
		459	0.96						
		460	1.21						
		252	1.39						
		253	0.47						
		254	0.21	1	1.021	127.3963	130.0583		
		255	0.19						
		461	0.26						
		462	0.17						
		248	0.21						
		262	0.85						
		263	1.34	2	0.567	0.0000	0.0000		
		259	2.22						
		463	0.60						
		464	0.82						
		260	0.89						
		261	0.74						
		262	0.76	3	1.312	0.0000	0.0000	43.3529	2124
Number of Transects =		238						Total Biomass =	19529
N Mi Surveyed		433.80						S.E. =	3319
								C.V. =	0.170

Table 17. Comparison of populations numbers at age (millions) and biomass estimates (t), spring spawners only, from acoustic surveys of White Bay - Notre Dame Bay.

Age	1983	1984	1985	1986	1987	1988	1989	1990
0	623.0	0.0	0.0	0.0	14.6	0.1		
1	979.1	187.7	0.0	12.6	0.4	29.6		
2	33.0	572.2	438.6	4.3	5.1	2.2		
3	4.5	4.6	832.5	27.1	1.6	1.3		
4	81.5	3.5	9.5	212.8	24.5	0.9		
5	4.2	34.2	0.0	17.6	65.4	9.5		
6	4.2	8.0	12.9	32.0	2.0	28.9		
7	22.2	6.1	0.0	36.2	1.8	2.0		
8	0.0	15.4	0.0	0.8	4.4	4.0		
9	9.1	0.0	0.0	0.3	1.3	5.2		
10	0.0	3.2	0.0	7.5	0.8	1.1		
11+	54.3	162.8	26.1	70.7	2.9	12.3		
Total	1815.1	997.7	1319.6	421.9	124.8	97.1		
Biomass (t)	136000	78700	198400	126200	30900	22500		

Age	1991	1992	1993	1994	1995	1996	1997	1998
0		3226.3		0.0				28.6
1		0.0		0.0				29.0
2		70.7		0.0				1.9
3		2.1		0.4				53.0
4		7.2		4.2				34.1
5		191.5		0.1				0.0
6		22.5		0.1				0.0
7		10.1		2.9				1.0
8		9.3		0.1				1.9
9		16.4		0.2				0.8
10		57.2		0.2				0.4
11+		18.8		0.6				0.9
Total		3632.1		9.7				151.8
Biomass (t)		104500		2100				19200

Table 18. Biological sampling details of herring, Sea Gem, Trip #2, Fortune Bay, March 1999.

Stratum	Survey Date(s)	Sample Date	Sample Location	Gear Type	Sample #'s	n	Mean Lgt. (mm)	Mean Wgt. (g)
82	Mar. 11 - 16	Mar. 15	Bay L'Argent	Res. PS	001, 002	200	253	118
84	Mar. 14 - 18	Mar. 17	Long Harbour	Res. PS	003, 004	200	327	279
87	Mar. 20	Mar. 20	Belleoram	Res. PS	005, 006	200	244	104
90	Mar. 21 - 22	Mar. 21	Bay de L'Eau	Res. PS	007, 008	200	250	111

Table 19. Mean lengths and weights, by stratum, used to calculate target strengths for 1999 Fortune Bay acoustic survey.

Stratum	Combined Samples	Mean Lgt. (mm)	Mean Wgt. (g)	TS / fish (dB)	TS / g
82	001, 002	253	118	-37.44	-58.16
84	003, 004	327	279	-35.21	-59.67
87	005, 006	244	104	-37.75	-57.92
90, 91	007, 008	250	111	-37.54	-57.99

Table 20 Fortune Bay herring biomass estimate from the 1999 acoustic survey

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM START NUMBER	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
82	4.258+07	314	0.30						
		315	0.39						
		316	0.31						
		317	0.28						
		318	0.25						
		319	0.36						
		320	0.32	1	0.506	0.0000	0.0000		
		321	0.24						
		322	0.13						
		323	0.10						
		324	0.09						
		325	0.11						
		326	0.09						
		327	0.11	2	0.197	0.0000	0.0000		
		328	0.19						
		329	0.11						
		330	0.12						
		331	0.17						
		332	0.25						
		333	0.19						
		334	0.17	3	0.271	0.0000	0.0000		
		335	0.51						
		336	0.64						
		337	1.54						
		338	1.97						
		339	1.41						
		340	1.35						
		341	1.18	4	1.946	117.6593	228.9239		
		342	1.56						
		343	1.51						
		344	0.91						
		345	1.15						
		346	1.26						
		347	1.35						
		348	1.51	5	2.093	978.4138	2047.5854		
		349	1.42						
		350	0.31						
		351	0.23						
		352	0.27						
		353	0.44						
		354	0.49						
		355	1.19	6	0.984	0.0000	0.0000	379.4192	15936
84	2.368+07	242	0.68						
		243	1.02						
		244	1.06						
		245	1.24						
		246	1.41						
		247	1.33	1	2.160	0.4707	1.0208		
		248	1.19						
		249	0.27						
		250	0.82						
		251	0.53						
		252	0.07						
		253	0.10	2	0.959	0.0000	0.0000		
		254	0.20						
		255	0.12						
		256	0.53						
		257							
		258	0.14						
		259	0.39	3	0.441	0.0000	0.0000		
		260	0.42						
		261	0.15						
		262	0.26						
		263	0.23						
		264	0.32						
		265	0.41	4	0.640	827.6084	529.9037		
		266	0.43						
		267	0.38						
		268	0.31						
		269	0.54						
		270	0.46						
		271	0.34	5	0.252	1677.0206	1485.6727	403.3104	11656

Table 20 cont' Fortune Bay herring biomass estimate from the 1999 acoustic survey

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (nmi.)	RANDOM START NUMBER	WEIGHTIN FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
87	9.10E+07	130							
		131							
		132	1.05						
		133	1.47						
		134	1.51						
		135	1.92	1	1.177	0.0000	0.0000		
		136							
		137							
		138	2.13						
		139	2.33						
		140	2.26						
		141	2.91	2	1.896	0.0000	0.0000		
		142							
		143							
		144	2.69						
		145	1.38						
		146	1.02						
		147	0.58	3	1.207	70.1668	84.6698		
		148							
		149							
		150	1.26						
		151	1.48						
		152							
		153	0.01	4	0.541	0.0000	0.0000		
		154							
		155							
		156	1.04						
		157	1.07						
		158	0.81						
		159	0.62	5	0.697	0.0000	0.0000		
		160							
		161							
		162	1.89						
		163	0.43						
		164	0.04						
		165	0.69	6	0.482	0.0000	0.0000	14.1116	1284
90	7.70E+07	85	0.52						
		86	0.66						
		87	0.64						
		88	0.79						
		89	0.81	1	0.662	0.0000	0.0000		
		90	2.02						
		91	1.79						
		92	1.77						
		93	1.78						
		94	1.73	2	1.724	0.0000	0.0000		
		95	2.59						
		96	2.72						
		97	1.95						
		98	1.06						
		99	1.03	3	1.774	57.6016	102.1576		
		100	0.97						
		101	0.55						
		102	0.25						
		103	0.58						
		104	1.15	4	0.690	0.0000	0.0000		
		105	0.27						
		106	0.29						
		107	0.06						
		108	0.14						
		109		5	0.144	0.0000	0.0000	20.4315	1492

Table 20 cont' Fortune Bay herring biomass estimate from the 1999 acoustic survey

STRATUM	STRATUM AREA (sq. n.mi.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM START NUMBER	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
21	2 314.467	21	0.79						
		22	0.61						
		23	0.75						
		24	1.14						
		25	1.66						
		26	2.49						
		27	2.63						
		28	2.70	1	1.447	0.0000	0.0000		
		29	2.66						
		30	2.29						
		31	2.15						
		32	2.67						
		33	2.73						
		34	2.81						
		35	1.61						
		36	2.68	2	2.380	0.0000	0.0000		
		37	1.94						
		38	2.18						
		39	2.89						
		40	1.92						
		41	1.58						
		42	1.58						
		43	1.11						
		44	1.27	3	1.548	0.0000	0.0000		
		45	0.55						
		46	0.80						
		47	0.92						
		48	1.07						
		49	1.12						
		50	1.20						
		51	1.28						
		52	1.00	4	0.900	0.0000	0.0000		
		53	0.82						
		54	0.77						
		55	0.79						
		56	0.71						
		57	0.84						
		58	0.83						
		59	1.00						
		60	0.91	5	0.756	0.0000	0.0000		
		61	0.62						
		62	0.87						
		63	0.50						
		64	0.42						
		65	0.50						
		66	0.42						
		67	0.55						
		68	0.41	6	0.475	0.0000	0.0000		
		69	0.18						
		70	0.09						
		71	0.17						
		72	0.18						
		73	0.13						
		74	0.24						
		75	0.52						
		76	0.35	7	0.211	951.9431	200.8078		
		77	0.31						
		78	0.38						
		79	0.43						
		80	0.40						
		81	0.32						
		82	0.35						
		83	0.11						
		84	0.20	8	0.263	0.0000	0.0000	25.0760	1780
								Total Biomass =	30408
								S.E. =	17448
								C.V. =	0.574

Table 21. Comparison of population numbers at age (millions) and biomass estimates (t), spring spawners only,from acoustic surveys of Fortune Bay.

Age	1986	1987	1988	1989	1990	1991	1992
0	0.0				0.0		0.0
1	0.0				0.0		0.2
2	0.0				0.0		5.1
3	0.0				22.4		0.1
4	18.4				2.2		0.7
5	0.6				0.3		9.2
6	2.1				0.3		0.7
7	1.8				7.3		0.0
8	0.9				19.3		0.4
9	0.6				0.8		5.6
10	1.5				0.8		22.8
11+	3.5				2.2		13.0
Total	29.4				55.6		57.8
Biomass (t)	9100				14400		18400

Age	1993	1994	1995	1996	1997	1998	1999
0			0.0		0.0		0.0
1			0.6		0.0		0.0
2			0.0		0.0		0.0
3			14.2		1.3		161.3
4			1.9		1.1		5.4
5			4.4		47.2		2.4
6			0.0		9.3		1.1
7			0.0		6.7		23.7
8			0.0		0.2		4.6
9			0.0		0.8		1.7
10			0.0		1.1		0.8
11+			0.3		5.3		10.0
Total			21.4		72.9		211.1
Biomass (t)			2500		15500		30000

Table 22. Biological sampling details of herring, Three T's 1, Trip #1, Bonavista Bay - Trinity Bay, November - December 1999.

Stratum	Survey Date(s)	Sample Date	Sample Location	Gear Type	Sample #'s	n	Mean Lgt. (mm)	Mean Wgt. (g)
40	Nov. 14 - 15	Nov. 14	Northwest Arm, T.B.	Res. PS	233	100	113	11
39	Nov. 13 - 17	Nov. 13	Traytown, T.B.	Comm. PS	234, 235	100	318	294
36	Nov. 17	Nov. 18	Catalina, T.B.	Res. Jiggers	236	6	337	333
34	Nov. 19 - 20	Nov. 19 Nov. 21	Princeton, B.B. Great Chance Hr., B.B.	Res. PS Res. PS	237, 238 239, 240	100 100	172	46
31	Nov. 21 - 22	Nov. 22	Newman Sound, B.B.	Res. PS	241	10	78	3
29	Nov. 25 - 30	Nov. 25 Nov. 27	Northwest Arm, B.B. Long Reach, B.B.	Res. PS Res. PS	256, 257 258	100 12	207	83
28	Nov. 29 - Dec. 3	Dec. 1	Cat Bay, B.B.	Res. PS	259, 260	100	326	324
27	Dec. 4 - 6	Dec. 5 Dec. 7 Dec. 7	Lewis Island, B.B. Indian Island, B.B. Trinity Gut, B.B.	Res. PS Res. PS Res. PS	261, 262 263, 264 265, 266	100 100 100	306	253

Table 23. Mean lengths and weights, by stratum, used to calculate target strengths for 1999 Bonavista Bay - Trinity Bay acoustic survey.

Stratum	Combined Samples	Mean Lgt. (mm)	Mean Wgt. (g)	TS / fish (dB)	TS / g
40	233	113	11	-44.44	-54.85
39	234, 235	318	294	-35.45	-60.13
36	236	337	333	-34.95	-60.17
34	237, 238, 239, 240	172	46	-40.79	-57.42
31	241	78	3	-47.66	-52.43
29	256, 257, 258	207	83	-39.18	-58.37
28	259, 260	326	324	-35.24	-60.34
27	261, 262, 263, 264, 265, 266	306	253	-35.79	-59.82

Table 24 Bonavista Bay - Trinity Bay herring biomass estimate from the 1999 herring acoustic survey.

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
44	1.54E+08	9	1.91						
		10	2.75						
		11	3.48						
		12	4.17						
		13	4.21	1	1.116	3.1573	3.5224		
		14	4.15						
		15	4.39						
		16	4.87						
		17	5.00						
		18	3.40	2	1.425	9.6603	14.2777		
		19	3.93						
		20	3.64						
		21	2.88						
		22	1.91						
		23	1.50	3	0.936	18.3159	17.1439		
		24	0.67						
		25	1.55						
		26	1.74						
		27	1.54						
		28	1.51	4	0.473	0.0000	0.0000	8.7360	1433
41	5.49E+07	58	0.32						
		59	0.18						
		60	0.07						
		61	0.17						
		62	0.11	1	0.493	0.0000	0.0000		
		63	0.43						
		64	0.42						
		65	0.33						
		66	0.32						
		67	0.31	2	1.028	0.0000	0.0000		
		68	0.51						
		69	0.31						
		70	0.40						
		71	0.31						
		72	0.45	3	1.051	0.0000	0.0000		
		73	0.44						
		74	0.26						
		75	0.36						
		76	0.29						
		77	0.33	4	0.955	58.3645	55.7119		
		78	0.29						
		79	0.32						
		80	0.37						
		81	0.93						
		82	0.70	5	1.483	0.0000	0.0000	11.1423	502
40	7.70E+07	83	0.10						
		84	0.06						
		85	0.41						
		86	0.17						
		87	0.10						
		88	0.08	1	0.243	0.0000	0.0000		
		89	0.33						
		90	0.07						
		91	0.35						
		92	0.57						
		93	1.41						
		94	0.55	2	1.024	0.0000	0.0000		
		95	0.28						
		96	0.32						
		97	0.35						
		98	0.73						
		99	0.98						
		100	1.00	3	0.969	1.0108	0.0793		
		101	1.04						
		102	1.23						
		103	1.26						
		104	1.22						
		105	0.91						
		106	0.88	4	1.727	0.5514	0.0520		
		107	0.95						
		108	1.15						
		109	1.06						
		110	0.38						
		111	0.19						
		112	0.29	5	1.037	1.0559	2.0259	0.7021	61

Table 24 (cont.) Bonavista Bay - Trinity Bay herring biomass estimate from the 1999 herring acoustic survey

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
34	1.34E+08	169	1.91						
		170	1.55						
		171	0.43	1	0.664	0.0000	0.0000		
		172	2.69						
		173	2.62						
		174	0.81	2	1.330	29.8600	39.8097	19.9549	2674
32	7.20E+07	181	0.40						
		182	1.22						
		183	0.38	1	0.823	0.0000	0.0000		
		184	0.68						
		185	0.58						
		186	1.60	2	1.127	0.2253	0.2652	0.1326	10
31	1.29E+08	187	0.60						
		188	1.62						
		189	1.43	1	1.053	0.5576	0.5874		
		190	2.03						
		191	0.68						
		192	0.57	2	0.947	0.0000	0.0000	0.2937	35
30	2.86E+08	193	1.76						
		194	1.30						
		195	3.54						
		196	4.41						
		197	3.52	1	1.154	0.0074	0.0085		
		198	1.05						
		199	2.36						
		200	2.48						
		201	3.39						
		202	2.09	2	0.903	0.0000	0.0000		
		203	3.23						
		204	3.86						
		205	2.97						
		206	3.70						
		207	2.41	3	1.255	0.0000	0.0000		
		208	3.47						
		209	1.15						
		210							
		211							
		212	6.56	4	0.889	0.0000	0.0000		
		213	2.42						
		214	2.56						
		215	4.70						
		216							
		217		5	0.769	0.0000	0.0000	0.0017	0
29	2.08E+08	218	0.87						
		219	0.75						
		220	0.89						
		221	1.06						
		222	3.26	1	0.603	13.4974	8.1445		
		223	3.00						
		224	1.73						
		225	1.16						
		226	1.91						
		227	2.52	2	0.909	8.9867	8.1515		
		228	3.02						
		229	4.64						
		230	4.35						
		231	3.81						
		232	4.83	3	1.819	8.4500	15.3711		
		233	4.03						
		234	2.87						
		235	2.45						
		236	2.63						
		237	2.18	4	1.247	0.0000	0.0000		
		238	1.14						
		239	1.35						
		240	0.49						
		241	0.55						
		242	0.55	5	0.421	0.0000	0.0000	5.3334	1317

Table 24 (cont.). Bonavista Bay - Trinity Bay herring biomass estimate from the 1999 herring acoustic survey.

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
26	2.00E+08	243	0.48						
		244	0.54						
		245	0.61						
		246	0.75						
		247	0.47						
		248	0.34	1	0.258	0.0000	0.0000		
		249	0.82						
		250	0.56						
		251	0.43						
		252	0.38						
		253	0.88						
		254	1.32	2	0.356	0.3204	0.1137		
		255	1.06						
		256	1.18						
		257	0.68						
		258	0.68						
		259	1.72						
		260	1.53	3	0.554	0.0000	0.0000		
		261	1.72						
		262	2.90						
		263	3.53						
		264	4.65						
		265	4.12						
		266	4.07	4	1.687	2.5811	4.3797		
		267	3.61						
		268	3.40						
		269	3.50						
		270	3.79						
		271	3.74						
		272	3.69	5	1.748	6.2432	10.9218		
		273	4.36						
		274	4.46						
		275	3.58						
		276	2.36						
		277	1.40						
		278	1.03	6	1.387	0.0000	0.0000	2.5692	514
27	2.77E+08	279							
		280							
		281							
		282	0.94						
		283	2.01						
		284	1.41	1	0.767	0.0000	0.0000		
		285	1.41						
		286	1.01						
		287	1.54						
		288	1.72						
		289	1.92						
		290	2.41	2	0.847	169.7715	226.6264		
		291	3.24						
		292	3.10						
		293	3.03						
		294	3.27						
		295	3.08						
		296	2.91	3	1.566	75.7097	118.5769		
		297	3.07						
		298	3.26						
		299	2.96						
		300	2.75						
		301	2.60						
		302	2.58	4	1.471	0.0000	0.0000		
		303	3.13						
		304	4.07						
		305	2.65						
		306	4.18						
		307	3.56						
		308		5	1.749	0.0000	0.0000		
		309							
		310							
		311							
		312							
		313							
		314		6	0.005	0.0000	0.0000	57.6042	16028
								Total Biomass =	22674
								S.E. =	4101
								C.V. =	0.181

Table 25. Comparison of population numbers at age (millions) and biomass estimates (t), spring spawners only, from acoustic surveys of Bonavista Bay - Trinity Bay.

Age	1984	1985	1986	1987	1988	1989	1990	1991
0	172.5	93.2	64.1	0.4	0.0		0.0	
1	63.6	0.0	171.5	0.0	0.3		9.3	
2	409.4	244.2	3.9	1.8	8.3		16.9	
3	1.8	378.2	6.3	0.3	26.4		156.8	
4	4.1	5.2	47.9	6.7	1.5		7.4	
5	11.7	0.0	1.7	26.6	10.0		3.2	
6	0.4	9.6	0.4	0.2	60.1		0.7	
7	0.0	0.0	0.4	0.1	1.1		1.6	
8	0.3	0.0	0.0	0.3	0.8		46.8	
9	0.0	0.0	0.0	0.1	0.0		0.2	
10	1.7	0.0	0.4	0.0	0.5		2.6	
11+	17.5	1.7	7.1	1.3	3.9		2.7	
Total	683.0	732.1	303.7	37.8	112.9		248.2	
Biomass (t)	59800	99900	25700	10400	29700		51900	

Age	1992	1993	1994	1995	1996	1997	1998	1999
0		0.0		133.1	0			14.2
1		1.5		0.2	0			0
2		197.3		0.0	6.1			4.2
3		20.8		2.9	0.2			2.6
4		0.6		31.0	2.3			15.8
5		2.1		5.4	106.6			9.8
6		12.7		0.5	14.6			0.9
7		1.0		1.3	1.4			0.2
8		1.2		5.8	2.2			19.1
9		0.4		1.1	10.2			0.8
10		2.1		0.4	0.8			0.2
11+		1.6		2.0	4.1			1.4
Total		241.3		183.8	148.4			69.4
Biomass (t)		23100		12300	33000			15200

Table 26. St. Mary's Bay - Placentia Bay herring biomass estimate from the 2000 acoustic survey

STRATUM	STRATUM AREA (sq. mi.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOMIZED SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
68	9.00E+07	111	0.26						
		112	1.41						
		113	2.34						
		114	2.73						
		115	2.22	1	1.049	0.0000	0.0000		
		116	1.63						
		117	0.86						
		118	1.44						
		119	1.76						
		120	3.05	2	1.023	102.7284	105.0727		
		121	3.19						
		122	2.55						
		123	1.57						
		124	1.38						
		125	1.40	3	1.181	0.0000	0.0000		
		126	1.02						
		127	2.28						
		128	1.69						
		129	0.65						
		130	3.75	4	0.748	0.0000	0.0000	26.2682	2364
60	2.23E+08	265							
		266							
		267	0.91						
		268	1.90						
		269	1.72						
		270	5.04	1	0.510	0.0000	0.0000		
		271	4.99						
		272	4.66						
		273	3.62						
		274	2.87						
		275	2.57						
		276	2.47	2	1.129	0.0000	0.0000		
		277	3.66						
		278	2.83						
		279	3.22						
		280	5.04						
		281	4.90						
		282	5.65	3	1.348	0.0000	0.0000		
		283	4.60						
		284	4.77						
		285	5.31						
		286	6.49						
		287	3.19						
		288	1.77	4	1.392	17.7136	24.6640		
		289	2.14						
		290	1.93						
		291	2.20						
		292	2.49						
		293	2.36						
		294	2.05	5	0.702	0.0000	0.0000		
		295	3.28						
		296	3.23						
		297	3.72						
		298	3.43						
		299	3.25						
		300	0.34	6	0.919	0.0000	0.0000	4.1107	918
56	2.38E+08	345	2.52						
		346	3.83						
		347	6.15						
		348	5.30	1	1.133	5.8550	6.6343		
		349	6.00						
		350	3.13						
		351	3.00						
		352	3.93	2	1.024	0.0000	0.0000		
		353	3.68						
		354	4.38						
		355	4.64						
		356	0.55	3	0.843	0.0000	0.0000	2.2114	527
							Total Biomass =		3810
							S.E. =		409
							C.V. =		0.107

Table 27. Comparison of population numbers at age (millions) and biomass estimates (t), spring spawners only, from acoustic surveys of St. Mary's Bay - Placentia Bay.

Age	1986	1987	1988	1989	1990	1991	1992	1993
0	0.0				0.0		0.0	
1	0.0				1.8		17.0	
2	0.0				3.0		1.0	
3	1.7				17.6		0.9	
4	136.6				13.2		0.3	
5	1.7				2.5		7.8	
6	1.7				0.9		5.0	
7	0.0				4.5		1.3	
8	0.0				50.3		0.4	
9	0.0				4.6		1.4	
10	0.0				4.5		7.5	
11+	0.0				7.1		5.9	
Total	141.7				110.0		48.5	
Biomass (t)	42200				32700		10200	

Age	1994	1995	1996	1997	1998	1999	2000
0	0.0		0.0		0.0		0.0
1	0.0		0.0		0.0		0.0
2	20.7		0.0		0.0		0.0
3	94.8		0.0		0.5		0.2
4	9.6		0.0		0.2		0.8
5	6.0		29.3		0.2		2.3
6	0.7		5.5		5.6		0.3
7	8.2		0.0		12.1		0.3
8	0.7		0.0		1.9		1.1
9	0.0		1.8		0.0		1.9
10	1.5		0.0		0.1		0.6
11+	26.2		18.3		1.1		0.6
Total	168.4		55.0		21.9		8.0
Biomass (t)	29300		17700		6300		2000

Table 28. Biological sampling details of herring from bottom trawl sets, Teleost Trip #87, northeast Newfoundland coast, January 2000.

Date	Time	Geographical Location	Latitude	Longitude	Set #	Depth (m)	Number Caught	Number Sampled	Mean Length (cm)	Min. Length (cm)	Max. Length (cm)
Jan. 5	0615 h	Smith Sound, Trinity Bay	48.10.5	53.37.3	1	189	5	5	20	14	31
Jan. 6	0730 h	Smith Sound, Trinity Bay	48.10.1	53.38.5	2	217	7	7	30	16	36
Jan. 7	2045 h	Bloody Reach, Bonavista Bay	48.44.6	53.52.8	5	125	4068	200	14	9	35
Jan. 9	0715 h	Roberts Arm, Green Bay	49.34.0	55.45.8	6	183	2143	200	13	8	34
Jan. 9	1115 h	Halls Bay, Green Bay	49.29.8	56.02.2	7	295	859	200	11	8	31
Jan. 13	1445 h	offshore Bonavista Bay	48.54.7	53.22.4	15	267	14	14	16	10	31

Table 29. Parameters, catch rates and abundance indices, by stock area and year, from commercial gill net logbook data.

Stock Area	Year	Number of Fishers	Mean Age of Fishers	Fishing Dates Start	Fishing Dates End	Total Nets Fished	Total Nights Fished	Mean Mesh Size (mm)	Mean Panel Size (sq m)	Total Logbook Catch (t)	Total Comm. Catch (t)	Catch / Std. Net / Night Fished (kg)	Current Year Abundance Index	Previous Year Abundance Index	Current Year Spawning Index
WBNDB	1996	16		01-Apr	18-Jun	108	440	64.7	299	68.5	229	38.4		5.75	
	1997	9	45.3	10-May	30-Jun	35	265	63.8	205	9.2	20	36.7	5.00	5.85	7.00
	1998	13	46.7	15-Apr	30-Jun	49	486	62.6	237	8.7	31	14.9	3.00	3.33	3.91
	1999	5	38.2	20-Apr	30-Jun	24	214	63.3	363	9.7	34	17.3	5.83	5.5	3.80
	2000	4	46.6	27-Apr	29-Jun	11	142	62.2	334	1.5	-	6.3	2.40		3.40
BBTB	1996	11		02-Apr	05-Jun	94	252	65.3	214	51.5	378	52.6		6.17	
	1997	6	45.0	07-Apr	27-Jun	38	287	66.1	312	39.4	201	27.9	8.00	5.80	8.33
	1998	6	45.0	02-Apr	21-Jun	52	191	66.0	245	16.3	170	13.5	5.00	6.00	7.33
	1999	5	51.0	02-Apr	29-Jun	19	173	66.0	330	28.7	195	27.8	6.00	4.83	3.50
	2000	7	49.6	08-Apr	16-Jun	33	249	65.4	349	25.7	-	48.9	5.14		3.67
SMBPB	1996	13		19-Mar	15-Jun	54	499	67.1	261	45.3	38	31.4		5.5	
	1997	6	50.3	12-Feb	24-Jun	39	334	68.3	265	15.4	20	20.7	3.50	3.29	4.50
	1998	8	52.4	17-Mar	25-Jun	41	1046	68.2	257	25.9	19	20.2	2.57	3.38	4.83
	1999	6	51.0	21-Feb	29-May	31	577	65.6	319	11.9	1	12.0	2.75	7	1.83
	2000	1	66.0	01-Apr	26-May	5	56	66.7	334	2.7	-	10.1	6.50		2.00
FB	1996	11		08-Apr	10-Jun	40	837	68.6	304	60	30	37.5		7.33	
	1997	13	49.8	29-Mar	28-Jun	57	1350	66.9	271	68.9	28	39.4	7.60	6.55	8.43
	1998	11	49.3	01-Apr	17-Jun	34	898	65.2	218	41.3	1	54.7	7.40	8.38	7.22
	1999	8	49.0	21-Mar	15-Jun	23	498	65.8	313	36.1	29	37.9	8.14	8	7.14
	2000	4	50.0	25-Mar	12-Jun	15	356	68.3	243	28.7	-	55.0	8.50		8.25

Table 30. Number of herring purse seine fishers who participated in the fishery and number of respondants to the questionnaire, by year, bay, and stock area.

Area	1996			1997			1998			1999			2000		
	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%
WB	7	7	100	2	2	100	2	2	100	2	2	100	-	-	-
NDB	11	10	91	13	12	92	4	4	100	5	5	100	-	-	-
WB-NDB	18	17	94	15	14	93	6	6	100	7	7	100	-	-	-
BB	13	13	100	8	7	88	7	6	86	8	8	100	-	-	-
TB	8	8	100	8	8	100	6	5	83	6	6	100	-	-	-
BB-TB	21	21	100	16	15	94	13	11	85	14	14	100	-	-	-
SMB	5	4	80	5	5	100	6	5	83	0	0		0	0	
PB	5	5	100	10	10	100	9	8	89	3	2	67	1	1	100
SMB-PB	10	9	90	15	15	100	15	13	87	3	2	67	1	1	100
Overall	49	47	96	46	44	96	34	30	88	24	23	96	1	1	100

Table 31. Herring purse seine fleet characteristics, average vessel length (ft.), average vessel capacity (lbs.), average seine lengths and depths (fathoms), by year and stock area.

Area	Parameter	1996	1997	1998	1999	2000
WB-NDB	Vessel Length	54.3	51.6	50.5	47.8	-
	Vessel Capacity	91353	70867	67500	82000	-
	Seine Length	150	149	145	146	-
	Seine Depth	23	22	24	21	-
BB-TB	Vessel Length	46.2	45.5	43.1	45.4	-
	Vessel Capacity	58095	56133	48364	59124	-
	Seine Length	150	141	137	136	-
	Seine Depth	24	22	22	23	-
SMB-PB	Vessel Length	49.9	50.1	50.6	43.5	42.0
	Vessel Capacity	74556	69800	64923	37500	38000
	Seine Length	189	198	194	163	165
	Seine Depth	33	32	30	30	25

Table 32. Landings, discards, and total removals (landings plus dead discards) by stock area and year (all amounts are in metric tons).

Area	Parameter	1996	1997	1998	1999	2000
WB-NDB	Total Landings	391.9	1800.5	301.9	882.4	-
	Discarded at Sea	445.5	2045.0	540.0	115.8	-
	Survival of Discards (%)	48.8	96.8	93.3	39.4	-
	Total Removals	620.0	1865.6	338.4	952.8	-
	Ratio (Removals : Landings)	1.58	1.04	1.12	1.08	-
BB-TB	Total Landings	737.5	736.0	621.0	893.5	-
	Discarded at Sea	209.0	47.0	8.5	219.0	-
	Survival of Discards (%)	50.0	59.8	50.0	68.8	-
	Total Removals	842.0	754.9	625.3	961.8	-
	Ratio (Removals : Landings)	1.14	1.03	1.01	1.08	-
SMB-PB	Total Landings	459.5	4400.9	1726.9	186.0	400.0
	Discarded at Sea	225.0	403.0	790.0	0.0	105.0
	Survival of Discards (%)	50.0	81.9	98.8	-	90.0
	Total Removals	572.0	4474.0	1736.1	186.0	410.5
	Ratio (Removals : Landings)	1.24	1.02	1.01	1.00	1.03

Table 33. White Bay - Notre Dame Bay catch numbers at age and catch weights at ages 2 to 11+ (columns), from 1971 to 1999 (rows), used as input for integrated catch at age analysis.

```
WHITE BAY-NOTRE DAM  CATCH NUMBERS AT AGE
 1          2
1971        1999
 2          11
 0
          1      129       89      161       64      425    10184      233      294      310
          5      250     2396      384       69      122      403     1363      209      806
          7      727     1811     2823      780      719      654      476     1865      794
          1        4      193     2182     5446     1192      697     1506      858     2476
          2      228      225      453     5438     7069     1123      838      810     3999
         56       24      504      237      864    10893    17145     1328     3364     8535
         30     1491      107      468      184      793     7363    12675     1055    15707
          1       55     2043      817     1034      517     2509    10807    11796    14379
          2       40       58     2058      924     1413      767     2222    14413    27508
        115       46     1240       92     1080       17      496      179     1450    14653
        445      152       43     1031       63      805       64      344      194    10908
         78      171      382       59      282       34      558       19      192     4059
          1       38       48       23       14       93        1       26        4      805
          6       12      174     1218       73      114      157       37      122     1938
          3      167      350      240     1484      108      275       94       81     2110
         26      915     3965      308      667     1258      148      162      179     1973
       1105      424     7201     2584     1651     1067     2088      399      442     4586
        401     1064      241     3984    11919     1036     1137     1454      315     2943
         29      128      613      124     3100    10566      370     1081      844     2178
          1     1916      365      637      240     2451     7360      532     1132     1148
         20      486    14183     1542      553      103     2145     4432      537     2701
        440      287      942     8940      483      371      211      722     2796     3509
          1       99       31      283     3614       75      199       70      544      881
          1        2     1054      121     1674     2199      108      192       69      441
          1       96      605     2747      123      701     1514      183      127      337
        157        1        3      484     1194       25      162      474        1       91
          2      498        2       60     3427     2938       51      209      359      427
          1      802      871       21       14      359      225      219       42       85
          1       81     1795     1450        2        3       83      180        3        9

WHITE BAY-NOTRE DAM  WEIGHTS AT AGE
 1          4
1971        1999
 2          11
 0
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.183    0.201    0.242    0.253    0.266    0.271    0.275    0.279    0.311
      0.050    0.160    0.199    0.297    0.282    0.295    0.299    0.307    0.305    0.328
      0.050    0.160    0.199    0.297    0.282    0.295    0.299    0.307    0.305    0.328
      0.050    0.148    0.197    0.233    0.264    0.290    0.300    0.305    0.306    0.345
      0.050    0.231    0.259    0.298    0.313    0.330    0.356    0.358    0.349    0.398
      0.050    0.150    0.202    0.241    0.343    0.305    0.357    0.367    0.398    0.383
      0.050    0.150    0.197    0.262    0.263    0.300    0.325    0.332    0.355    0.376
      0.050    0.144    0.201    0.223    0.272    0.279    0.316    0.330    0.328    0.371
      0.050    0.146    0.207    0.233    0.248    0.293    0.318    0.349    0.330    0.389
      0.050    0.148    0.214    0.235    0.256    0.295    0.324    0.323    0.333    0.414
      0.050    0.124    0.195    0.227    0.249    0.273    0.296    0.311    0.332    0.412
      0.050    0.122    0.179    0.234    0.259    0.279    0.296    0.329    0.336    0.418
      0.050    0.124    0.177    0.212    0.247    0.275    0.287    0.312    0.331    0.393
      0.050    0.122    0.164    0.195    0.229    0.261    0.277    0.286    0.322    0.372
      0.050    0.095    0.156    0.169    0.201    0.252    0.279    0.298    0.304    0.343
      0.050    0.074    0.173    0.187    0.210    0.239    0.271    0.283    0.304    0.330
      0.050    0.124    0.141    0.166    0.200    0.220    0.247    0.286    0.288    0.324
      0.050    0.126    0.158    0.167    0.201    0.239    0.254    0.274    0.289    0.371
      0.050    0.106    0.154    0.150    0.190    0.223    0.250    0.259    0.292    0.354
      0.050    0.118    0.147    0.170    0.202    0.227    0.237    0.248    0.287    0.364
      0.050    0.112    0.159    0.176    0.216    0.245    0.254    0.259    0.294    0.340
```

Table 34. Bonavista Bay - Trinity Bay catch numbers at age and catch weights at ages 2 to 11+ (columns), from 1971 to 1999 (rows), used as input for integrated catch at age analysis.

```
NOTE HERRING - CATCH NUMBERS AT AGE
 1          2
1971        1999
2  11
1
```

1	690	311	102	64	361	1373	151	126	522
1	0	1347	389	91	75	86	480	14	213
1	1	60	4887	126	96	1	48	271	1
1	1	2	235	4795	424	151	294	69	1849
1	15	134	163	2564	14330	455	995	727	1679
14	7	493	122	169	4897	20697	909	854	4306
1	248	135	759	227	50	6209	23506	774	5890
22	76	357	122	251	112	598	4412	13394	5956
1	960	167	766	19	436	101	530	5575	19994
15	3	195	43	292	53	564	75	967	12259
15	746	53	256	26	269	23	321	85	10762
1	8	11	3	30	5	35	5	65	1186
1	1	34	7	2	19	1	8	7	159
1	22	35	210	9	9	12	2	2	154
33	173	70	87	351	37	27	13	22	797
193	662	4445	261	161	262	38	10	31	657
1132	413	2845	16208	334	359	126	33	6	956
447	9914	287	3674	21739	782	713	8	55	1247
561	1063	3323	264	1428	8639	13	216	100	508
58	9094	422	2350	94	629	4439	235	325	466
689	219	13591	2580	1659	347	1550	3505	447	891
811	7056	271	12612	2422	579	194	1394	2054	653
154	821	160	344	3778	427	395	132	657	1092
1	584	819	303	1072	3878	479	471	530	2614
1	167	2645	349	64	152	978	172	163	649
1	24	63	2638	345	46	157	430	11	300
35	302	13	96	3230	182	7	1	29	96
54	524	543	170	126	1328	94	4	4	87
50	98	922	644	11	14	3175	922	62	144

```
DEPTH HERRING - WEIGHTS AT AGE
1  3
1971  1999
2  11
1
```

0.064	0.133	0.199	0.215	0.238	0.254	0.273	0.296	0.306	0.343
0.065	0.133	0.199	0.215	0.238	0.254	0.273	0.296	0.306	0.343
0.065	0.133	0.199	0.215	0.238	0.254	0.273	0.296	0.306	0.343
0.065	0.133	0.199	0.215	0.238	0.254	0.273	0.296	0.306	0.343
0.065	0.133	0.199	0.215	0.238	0.254	0.273	0.296	0.306	0.343
0.065	0.133	0.199	0.215	0.238	0.254	0.273	0.296	0.306	0.343
0.065	0.133	0.199	0.215	0.238	0.254	0.273	0.296	0.306	0.343
0.065	0.14	0.21	0.25	0.275	0.315	0.34	0.35	0.37	0.39
0.065	0.139	0.205	0.25	0.259	0.288	0.294	0.285	0.296	0.335
0.065	0.145	0.21	0.266	0.302	0.311	0.317	0.33	0.312	0.348
0.065	0.145	0.245	0.292	0.32	0.325	0.337	0.352	0.359	0.365
0.065	0.145	0.245	0.292	0.32	0.325	0.337	0.352	0.359	0.365
0.065	0.204	0.252	0.304	0.332	0.35	0.37	0.384	0.381	0.441
0.065	0.13	0.193	0.241	0.269	0.315	0.328	0.333	0.342	0.387
0.065	0.118	0.189	0.234	0.274	0.301	0.343	0.339	0.365	0.393
0.065	0.123	0.188	0.235	0.278	0.299	0.327	0.36	0.366	0.399
0.065	0.136	0.205	0.252	0.268	0.289	0.318	0.396	0.326	0.397
0.065	0.129	0.196	0.233	0.255	0.285	0.318	0.358	0.37	0.421
0.065	0.147	0.212	0.248	0.265	0.28	0.295	0.323	0.347	0.411
0.065	0.144	0.219	0.262	0.272	0.295	0.314	0.353	0.362	0.421
0.065	0.135	0.202	0.257	0.287	0.286	0.289	0.322	0.339	0.387
0.065	0.133	0.174	0.216	0.256	0.287	0.287	0.282	0.307	0.34
0.065	0.128	0.21	0.211	0.239	0.264	0.311	0.299	0.309	0.343
0.065	0.081	0.144	0.178	0.224	0.255	0.285	0.308	0.306	0.345
0.065	0.101	0.155	0.172	0.218	0.237	0.27	0.293	0.289	0.332
0.065	0.103	0.161	0.189	0.215	0.258	0.271	0.286	0.305	0.345
0.065	0.115	0.161	0.204	0.214	0.235	0.272	0.287	0.301	0.341
0.065	0.143	0.174	0.219	0.236	0.245	0.254	0.256	0.292	0.339
0.065	0.148	0.187	0.207	0.234	0.246	0.275	0.284	0.287	0.340

Table 35. St. Mary's Bay - Placentia Bay catch numbers at age and catch weights at ages 2 to 11+ (columns), from 1970 to 1999 (rows), used as input for integrated catch at age analysis

```
SMPB HERRING  AS+BS) - CATCH NUMBERS AT AGE
 1   2
1970  1999
 2  11
 1
      174      720     4435       61       73      716      178       91       65      309
        2      658      105     2113      155      282       88       37       57      410
        4      581    20436      909      168      476      687      483      144      942
        5      131      227    16522      847     6767      147      241      261     1052
      581      262      238      203   144574      516     6144      231      289     1594
       79     2235      478      215     1773    13947      452     3397      387     2000
       61      403     1910      422      334      894     5639      285     2207     1690
       32     1425      167      784      295      131     1106     4856      156     5974
       40      119     1840      556      680      308      228      550     3879     2746
       27      668      291     2406      494      697      301       67      502     5133
      141      112      329      188     1352      476      549      164      262     3465
        1      148      181      227       61      349       78       87        6      485
        3        1        2       10        5        3       14        8        4       71
        1        5       20        3       14        8        1        9        1       43
        0        9       41      137       36       24       29        3       11       52
        1        7       27       47      107       61       39       35        8      149
        1        1      159       43       43      106       32       16        9       45
       46       78       14      534      103       77       91       27        3       23
        1        1       42      193     2686      209      248      236       41      200
       20       51       14       16       32      519       77      167      185      198
        1      152      226      125       64       54      541      103      189      301
       37        1      236      247      210       35      135      591      126     1443
       68       47       14      371      281       88       80      158      563     1444
        5       62       36      219      476      291      115      104       59     2037
       34      161       12       96      132      405      281      276      172     1455
        1      339     1523      149       35      106      162       87       94      696
       19       38      264     1269      196       93       51       60       16      251
      435      201      295     1844     9468     1825      363      382      100     1010
      151      567      436      505     1145     3976      993      560       64      364
        1       21       21        1       42      147      398      105      126      189
```

```
SMPB HERRING  AS+BS) - WEIGHTS AT AGE
 1   3
1970  1999
 2  11
 1
    0.065    0.164    0.236     0.25    0.273    0.262    0.282    0.302    0.325    0.349
```

Table 36. White Bay - Notre Dame Bay age-disaggregated spring (1988 - 99) and fall (1981 - 91) research gill net catch rates (where columns are ages 3 to 10 and rows are years) and age-aggregated acoustic biomass estimates (1983-98) used as input for integrated catch at age analysis.

```
WHITE BAY/ND - TUNING DATA
101
Spring Research Gill Net Catch Rates
1988          1999
                1       0.25    0.50
                10
        4.7       1.9      25.2      59.6       5.6         7      12.0       1.8
       16.0      43.8      11.2     126.9     182.9        9.      16.0      24.3
       89.5      54.6      52.5      16.3     144.6     195.5      11.5      26.5
       11.0     247.7      28.8      13.7       7.5      84.2     164.3      31.9
        0.1      21.4     491.7      33.5      13.7      10.3      47.2     127.4
        1.5      10.9      51.0     359.9      18.8       6.7      13.4      29.1
        0.4     332.0      14.6      52.1     182.9      14.1       7.6      12.9
        0.1      19.5     803.1      20.2      45.9     104.1       8.4       9.5
        0.1       0.9      47.8     386.0      12.7       2.6      34.2       5.2
        3.0       0.4       4.2      77.1     139.5       9.6      17.8      31.0
        0.9     117.6       0.2       1.2      10.3      43.5       1.7       6.9
        0.5      70.3      85.1       1.0       0.4       9.5      15.0       2.8
Fall Research Gill Net Catch Rates
1981          1990
                1       0.75    1.00
                10
        5.4       1.5      25.2       1.0       5.3       0.5       1.9       0.8
       29.1       5.0       3.5       1.9       0.8       9.3       0.1      15.5
       96.1      91.4       7.3      14.1      19.8       2.6      22.4       5.2
        6.8      19.3      84.0       4.2       8.5      14.0       0.9       8.5
      134.5      19.0      11.6      60.1       7.1       6.7       7.5       5.2
        9.0     197.0      12.5       9.0      38.2       3.8       2.6       3.1
        0.6      98.8     352.0      35.1      10.0      57.3       6.6       5.5
        3.9       3.6      18.0      90.4       7.8       8.6      13.3       1.2
       10.8      70.3       7.6      39.2     123.8       4.1      12.2      25.6
      120.9      21.1       7.0       3.5      12.1      51.8       7.3      10.8
        5.2     252.1      15.8       2.4       3.1      10.3      52.3       1.7
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
      -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0

'WHITE BAY/ND - TUNING DATA'
                10        2
'YEAR'     'VPA'      'ACOU'
      83      -11     136000
      84      -11      78700
      85      -11     190400
      86      -11     136200
      87      -11      38900
      88      -11      22500
      89      -11         -1
      90      -11         -1
      91      -11         -1
      92      -11     104300
      93      -11         -1
      94      -11       2100
      95      -11         -1
      96      -11         -1
      97      -11         -1
      98      -11      19500
      99      -11         -1
      00      -11         -1
```

Table 37. Bonavista Bay - Trinity Bay age-disaggregated spring (1988 - 99) and fall (1980 - 91) research gill net catch rates (where columns are ages 3 to 10 and rows are years) and age-aggregated acoustic biomass estimates (1984-99) used as input for integrated catch at age analysis.

```
NSFC HERRING   TUNING DATA
205
Spring Res. Gill Net Catch Rates
1988        1999
  1           1       0.25    0.50
  4          10
1     5.6       0.3       2.3      29.2       0.5       0.4       0.6       0.1
1     2.7      21.8       5.6       5.5      37.7       0.4       0.6       0.7
1     9.8       0.3      27.3       4.5      42.1      60.8       3.8       3.2
1     6.2      50.7      13.0      27.8       9.2      19.8      62.3       3.8
1     1.3       1.2      46.2       8.1      10.3       2.7      17.6      34.8
1     2.6       1.7       5.2      50.1       6.4       7.0       3.7      13.1
1     0.7      16.8       3.6      12.6      85.0       6.5       6.9       7.5
1     0.1      54.1       3.2       1.7       4.6      19.9       2.6       3.0
1     4.1       0.9     140.9      20.8       5.3       5.5      20.8       3.7
1     2.8       0.7       4.3     181.9      23.7       5.6       7.0      16.7
1     1.2       5.7       0.2       1.7      62.3       4.6       2.1       1.3
1     0.1      17.6       1.2       0.4       0.6      24.8       1.4       0.3
Fall Res. Gill Net Catch Rates
1980        1999
  1           1       0.75    1.00
  4          10
1     1.3      10.8       0.9       4.3       0.3       0.3       0.1       1.9
1     1.0       0.2       0.8       0.2       1.6       0.1       1.2       0.1
1    74.9      18.8       5.0      14.6       0.1       3.6       0.1       0.6
1     6.1     111.9      11.0       4.3      11.5       0.2       4.5       1.0
1     2.6       7.4      57.3       2.3       1.3       2.0       0.1       1.9
1    58.1       4.0       1.8       8.0       5.1       0.1       0.6       0.1
1     0.8     139.9       2.1       2.2       4.6       0.6       0.1       0.8
1     8.4       4.4      41.6       2.9       1.7       1.6       0.5       0.2
1    14.7       1.5       6.9      50.9       1.9       1.6       1.1       0.2
1     3.0      10.3       1.1       4.2      20.8       0.5       1.0       1.0
1    49.9      10.2       8.3       0.5       2.9      13.4       1.3       1.2
1     2.7      58.4       8.1      14.0       2.1       2.5      23.2       2.1
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0
1   -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0     -11.0

'NSFC HERRING - TUNING DATA'
                17          2
'YEAR'    'SPA'      'ACOU'
      1984      -11     53800
      1985      -11     39900
      1986      -11     25700
      1987      -11     20400
      1988      -11     99700
      1989      -11       -11
      1990      -11     61900
      1991      -11       -11
       992      -11       -11
      1993      -11     23100
      1994      -11       -11
      1995      -11     12300
      1996      -11     11000
      1997      -11       -11
      1998      -11         2
      1999        1      5200
      2000      -11       -11
```

Table 38. St. Mary's Bay - Placentia Bay age-disaggregated spring (1982 - 99) research gill net catch rates (where columns are ages 3 to 10 and rows are years) and age-aggregated acoustic biomass estimates (1986-2000) used as input for integrated catch at age analysis.

```
SMPB HERRING (AC/GS)   TUNING DATA
101
Research Gill Net Catch Rates
1982          1999
 3             1       0.25    0.50
 4            10
 5
 6       0.8       1.7       2.9       1.6       0.2       1.9       0.5       0.4
 7      10.7      11.1       5.7       5.8       4.0       0.8       5.4       0.9
 8      24.8      35.3      65.6      18.7      23.8       8.9       4.6      10.4
 9      60.1      36.7      29.1      83.8      16.9      14.3      10.9       5.2
10       1.0     133.6      25.1      27.6      69.7      12.0       3.7       3.9
11       1.7       6.9     140.7      26.9      25.2      24.6       9.6       1.3
12       1.3       5.3       3.8     103.1      11.6      19.5      11.2       1.3
13      21.5       7.9       3.6       4.8      68.1       6.1      14.9       8.0
14      11.1      30.1      10.2       5.1       7.9      73.2       9.0      16.7
15       1.2      16.8      15.2       4.9       1.6       3.4       9.7       2.0
16       2.0       1.8      25.5       9.1       4.0       1.8       3.6       8.5
17       1.6       4.7       5.8      15.3       6.2       4.1       1.9       2.7
18      15.8      30.8       5.1       2.5       9.7       6.2       5.7       3.5
19      11.0      24.7       4.3       0.4       1.4       3.2       1.6       0.4
20       0.3      55.9     173.6      27.1       9.4       7.8      11.6       3.6
21       0.5       1.0      23.2      75.4      26.3       4.6       6.2       3.5
22      33.4      17.5       3.0      12.6      31.3      12.3       3.4       2.3
23      21.3      42.2      23.6      19.8      16.1      35.7      11.3       3.6
```

```
'SMPB HERRING - TUNING DATA'
          1          15           2
'YEAR'     'SURA'      'ACOU'
      1986        -11      42200
      1987        -11        -11
      1988        -11        -11
      1989        -11        -11
      1990        -11      19800
      1991        -11        -11
      1992        -11      12000
      1993        -11        -11
      1994        -11      43900
      1995        -11        -11
      1996        -11      29400
      1997        -11        -11
      1998        -11      11600
      1999        -11        -11
      2000        -11       3800
```

Table 39. White Bay - Notre Dame Bay population numbers at age from integrated catch at age analysis

Population Abundance (1 January)

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	934.42	100.23	17.24	20.35	6.13	46.92	10.24	13.56	3.41	4.35	48.34	49.74	14.36	203.66	76.49
3	608.58	765.04	82.14	14.04	21.25	4.20	38.37	3.33	15.21	3.70	5.73	40.16	37.49	15.80	166.92
4	38.69	498.15	674.20	66.39	11.49	13.28	3.42	29.60	0.79	12.40	2.26	5.37	32.58	34.57	11.97
5	182.82	31.60	406.69	611.54	54.41	9.21	13.69	2.70	22.66	5.50	9.04	3.06	4.10	26.60	24.42
6	52.86	149.53	25.55	329.60	415.90	41.14	7.33	10.73	1.92	15.90	4.42	6.29	4.12	3.34	20.68
7	122.55	43.20	102.37	20.23	264.83	335.52	35.35	5.83	7.90	1.23	10.05	2.56	4.41	3.36	2.47
8	104.77	99.95	35.28	89.53	15.49	210.53	264.87	28.23	4.31	5.20	1.04	8.14	2.44	3.93	2.85
9	30.97	76.60	92.47	28.29	80.86	11.07	156.90	210.21	20.85	2.84	3.81	0.70	7.25	2.36	3.08
10	20.79	30.04	61.48	66.33	21.80	65.45	8.36	117.03	160.35	15.07	2.16	2.81	0.63	5.91	1.90
11	254.20	118.47	28.97	183.93	107.63	166.05	124.41	143.14	309.85	152.27	121.57	59.37	127.14	93.59	48.51

x 10 ^ 6

Population Abundance (1 January)

AGE	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	5.05	11.19	7.05	85.68	12.72	2.93	32.26	7.23	0.80	0.14	144.65	78.38	15.59	17.00	7.34
3	64.37	4.11	8.16	5.40	65.49	10.42	2.37	25.56	5.62	0.85	8.19	118.40	59.88	12.76	5.93
4	136.49	51.87	3.07	5.74	4.31	54.33	8.16	1.74	20.92	4.81	0.52	0.16	96.16	48.75	10.43
5	10.30	109.09	35.94	2.25	4.15	3.27	38.96	5.85	1.41	16.97	3.54	0.42	0.13	77.07	34.62
6	20.19	8.16	66.09	26.73	1.73	2.82	1.30	16.51	4.42	1.02	0.56	2.69	0.30	0.09	61.15
7	15.59	15.92	5.19	43.47	19.09	1.20	1.01	3.63	11.99	3.01	0.42	0.28	1.02	0.22	0.07
8	2.08	11.63	11.07	3.31	28.09	13.42	0.89	1.15	0.46	8.50	1.26	0.31	0.28	1.31	0.17
9	1.92	1.53	7.64	6.86	2.39	14.76	9.06	0.54	0.83	0.31	3.32	0.92	0.21	3.04	1.02
10	2.46	1.42	0.89	4.95	6.28	1.47	3.10	6.76	0.33	0.43	0.05	2.07	0.47	0.12	0.21
11	26.85	14.71	8.34	12.77	6.37	6.04	10.17	12.34	4.16	1.00	1.41	3.96	1.09	0.32	0.30

x 10 ^ 6

Table 40. Bonavista Bay - Trinity Bay population numbers at age from integrated catch at age analysis.

Population Abundance (1 January)

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	191.64	91.46	43.65	13.20	1.32	4.64	1.45	3.13	0.84	1.93	4.15	21.19	14.73	183.84	55.44
3	388.20	154.92	46.86	2.67	10.28	1.08	3.75	1.59	2.66	0.44	1.61	5.73	17.35	12.08	116.91
4	21.04	481.96	128.36	21.66	2.31	8.36	0.92	2.89	1.27	1.93	0.21	1.19	4.69	14.29	9.87
5	22.19	16.85	392.56	105.12	17.73	1.77	6.56	0.55	2.03	0.89	1.41	0.04	0.91	3.81	11.51
6	21.04	16.07	13.51	316.99	85.85	14.37	1.34	4.69	0.34	0.95	0.89	0.95	0.25	0.74	2.93
7	7.90	17.17	14.71	10.95	255.20	67.99	11.62	0.84	3.61	0.26	0.54	0.54	0.73	0.16	0.60
8	66.63	6.14	13.99	11.96	8.52	196.01	51.54	9.46	0.63	2.56	0.17	0.19	0.44	0.58	0.12
9	1.92	53.32	4.95	11.45	9.65	6.61	141.82	36.35	7.21	0.42	1.86	0.11	0.13	0.36	0.47
10	3.70	1.44	42.22	4.01	9.11	7.01	4.60	95.22	25.79	5.42	0.26	1.23	0.09	0.09	0.29
11	15.35	21.87	0.16	107.44	21.04	35.33	84.97	42.34	92.49	68.77	37.30	22.50	7.12	7.04	10.54

x 10 ^ 6

Population Abundance (1 January)

AGE	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	10.37	56.85	32.39	132.31	8.08	7.90	38.53	157.45	4.29	2.18	24.87	102.01	18.90	33.92	16.62
3	45.54	8.30	45.40	20.57	107.41	6.60	6.41	31.35	128.53	3.50	1.78	20.31	83.48	15.46	44.10
4	177.43	36.89	6.42	28.26	15.90	85.95	4.95	4.93	24.93	102.18	2.83	1.45	16.56	67.79	13.53
5	8.02	141.26	27.64	5.02	20.14	10.38	59.67	3.60	3.82	19.30	81.41	2.28	1.18	13.35	54.46
6	9.38	6.33	101.04	19.32	3.97	14.93	7.31	38.67	2.65	2.80	14.97	65.00	1.84	0.94	10.53
7	2.08	7.50	4.68	63.16	14.53	2.87	8.32	4.54	27.84	1.90	2.15	11.90	52.31	1.46	0.73
8	0.46	1.47	5.82	3.29	43.84	11.06	1.52	5.74	3.44	21.04	1.50	1.73	9.64	41.68	1.16
9	0.08	0.34	1.03	4.12	2.68	33.02	6.83	1.22	4.28	2.56	16.44	1.20	1.40	7.69	33.19
10	0.37	0.05	0.25	0.68	3.18	2.04	21.33	4.72	0.92	3.24	2.01	13.22	0.97	1.12	6.10
11	7.84	8.57	5.63	4.49	5.43	3.51	3.44	11.66	27.59	13.64	13.40	7.14	3.16	4.29	4.27

x 10 ^ 6

Table 41. St. Mary's Bay - Placentia Bay population numbers at age from integrated catch at age analysis.

Population Abundance (1 January)

AGE	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	230.11	188.65	6.79	3.71	18.63	6.41	16.98	3.52	6.87	2.05	6.62	58.80	32.85	13.59	58.75
3	9.85	211.37	173.86	6.56	4.40	14.38	5.15	15.21	3.84	5.19	1.74	5.30	49.03	26.76	10.69
4	84.96	7.78	172.93	14.41	4.33	3.52	9.76	3.59	12.07	2.17	3.65	1.12	4.27	39.66	21.92
5	5.56	66.31	6.73	173.98	11.82	3.27	3.45	6.25	3.21	7.40	1.61	2.79	0.76	3.11	30.15
6	4.07	4.32	51.66	4.70	86.79	9.29	1.44	1.62	4.43	1.96	3.97	1.07	2.07	0.61	2.78
7	5.10	4.67	3.42	33.63	2.94	58.02	6.51	1.73	1.56	3.01	0.56	2.07	0.32	1.49	0.59
8	1.79	3.53	3.72	2.41	24.72	1.95	34.97	4.12	1.30	0.59	1.84	0.35	1.39	0.07	1.38
9	2.13	1.31	2.81	2.43	1.84	14.72	1.26	23.55	2.38	0.86	0.22	1.07	0.24	1.27	0.55
10	0.94	1.69	0.98	1.90	1.77	1.30	9.00	0.78	15.81	1.45	0.62	0.09	0.75	0.19	0.90
11	4.48	12.09	6.14	7.64	9.76	6.72	6.71	14.86	11.19	14.81	8.26	5.82	13.38	8.34	4.26

x 10 ** 3

Population Abundance (1 January)

AGE	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2	7.63	8.45	9.13	14.96	18.41	3.40	7.05	14.39	59.95	33.27	4.83	15.18	39.48	21.97	13.43
3	44.00	6.10	4.48	5.44	12.25	15.07	2.75	5.74	11.77	49.04	27.21	3.95	12.91	31.34	28.38
4	9.74	39.35	4.96	3.63	6.09	10.01	12.29	2.26	4.67	9.88	39.91	22.17	3.22	10.29	24.91
5	27.90	7.13	37.03	4.08	2.93	4.96	8.12	9.95	1.83	3.76	7.75	32.53	18.00	2.59	7.75
6	24.57	14.66	3.86	25.78	1.14	2.36	3.94	6.40	7.74	1.44	2.96	6.12	25.71	14.72	1.47
7	2.24	20.02	11.97	4.69	18.61	2.54	1.87	3.10	4.98	6.08	1.12	2.34	4.85	20.97	7.87
8	0.38	1.78	16.30	9.73	3.62	14.86	2.00	1.46	2.38	3.86	4.73	0.88	1.81	3.68	15.78
9	1.10	0.27	1.43	13.26	7.74	2.89	11.63	1.54	1.10	1.83	2.96	3.64	0.69	1.52	1.85
10	0.44	0.87	0.21	1.15	10.60	6.13	2.24	8.93	1.15	0.84	1.38	2.21	2.62	0.54	0.93
11	4.29	4.35	2.41	5.60	13.13	11.40	42.14	32.35	59.59	38.37	21.59	9.60	6.21	0.96	0.47

x 10 ** 3

Table 42 . Calculation of Fortune Bay research gillnet catchability coefficient where population numbers are calculated from integrated catch at age (ICA)and adjusted population numbers (Adj. Nos.) exclude the catch; the catchability coefficient (75.20) is then applied to current and historical research gillnet catch rates to calculate population siz

Year	Age	ICA Nos.	Catch	Adj. Nos.	RGN C.R.
1970	5	2640	133	2507	5.6
	6	15930	281	15649	16.7
	7	16670	7894	8776	236.5
	8	500	233	267	2.8
	9	260	16	244	5.6
	10	410	225	185	0.0
	11	470	257	213	8.3
1971	5	47580	23525	24055	168.3
	6	2040	1165	875	15.2
	7	12790	1598	11192	31.5
	8	6600	3514	3086	86.4
	9	200	132	68	0.0
	10	200	148	52	6.2
	11	720	537	183	13.8

Regression Output:	
Constant	0
Std Err of Y Est	6283.729
R Squared	0.286
No. of Observations	14
Degrees of Freedom	13
X Coefficient(s)	75.204
Std Err of Coef.	20.540

	Age 5+RGN Catch Rate	Age 5+ Pop'n. Nos.	Mean Wgt	Age 5+ Biomass	5+ Acous. Biomass
1983	114.4	8602	0.404	3476	
1984	133.7	10052	0.410	4120	
1985	444.5	33432	0.322	10756	
1986	175.7	13211	0.338	4463	4177
1987	690.9	51959	0.280	14529	
1988	517.3	38907	0.290	11279	
1989	913.3	68688	0.325	22330	
1990	377.8	28409	0.342	9727	9984
1991	506.0	38052	0.331	12580	
1992	327.5	24626	0.323	7956	16221
1993	413.0	31060	0.310	9628	
1994	634.6	47724	0.309	14748	
1995	661.0	49710	0.290	14440	
1996	844.2	63486	0.317	20149	
1997	980.0	73700	0.311	22950	15762
1998	1218.2	91614	0.278	25497	
1999	735.7	55329	0.297	16432	12369
2000	641.5	48244	0.31	14964	

Table 43. Catch projections, by stock area, for 2001 and 2002, assuming fixed catches in 2000; also risk analysis of the probability that spawning stock biomass will be less than the respective reference biomass levels of the stock status classification system.

White Bay - Notre Dame Bay

F	Year	Catch (t)	Probability Mature Biomass < Zone 2
~0.00	2001	<100	46%
	2002	<100	44%
0.05	2001	1300	52%
	2002	1180	53%

Bonavista Bay - Trinity Bay

F	Year	Catch (t)	Probability Mature Biomass < Zone 4
0.1	2001	2430	27%
	2002	2020	32%
0.2	2001	4650	32%
	2002	3580	40%

St. Mary's Bay - Placentia Bay

F	Year	Catch (t)	Probability Biomass < Zone 3	Probability Biomass < Zone 4
0.1	2001	1380	29%	82%
	2002	1300	34%	85%
0.2	2001	2620	38%	86%
	2002	2200	46%	88%

Fortune Bay

Year	Catch (t)	Probability Biomass < Zone 3	Probability Biomass < Zone 4
2001	1000	32%	62%
2002	1000	35%	64%
2001	2000	36%	64%
2002	2000	43%	68%

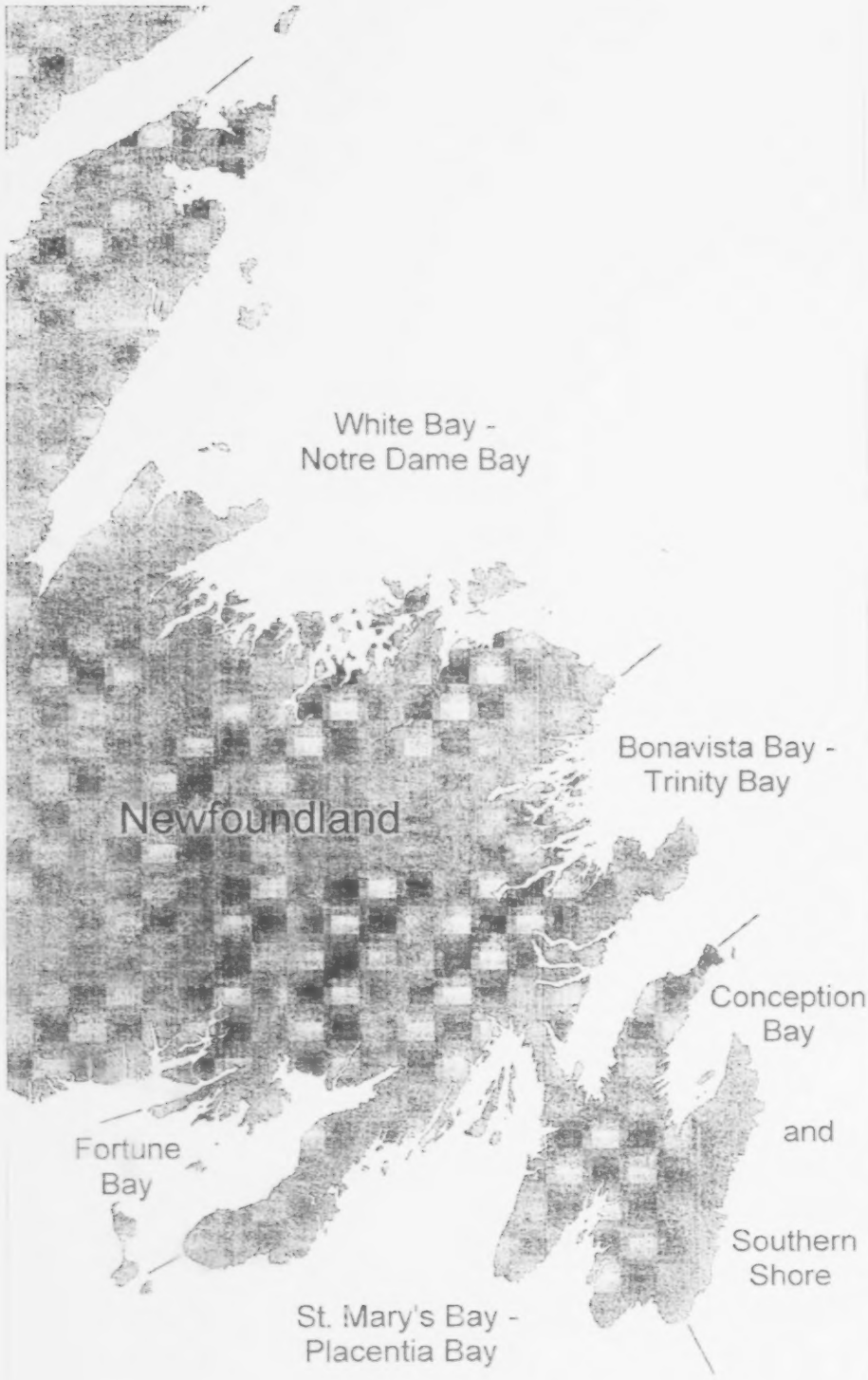

Figure 1. Area map indicating herring stock complexes within the Newfoundland Region.

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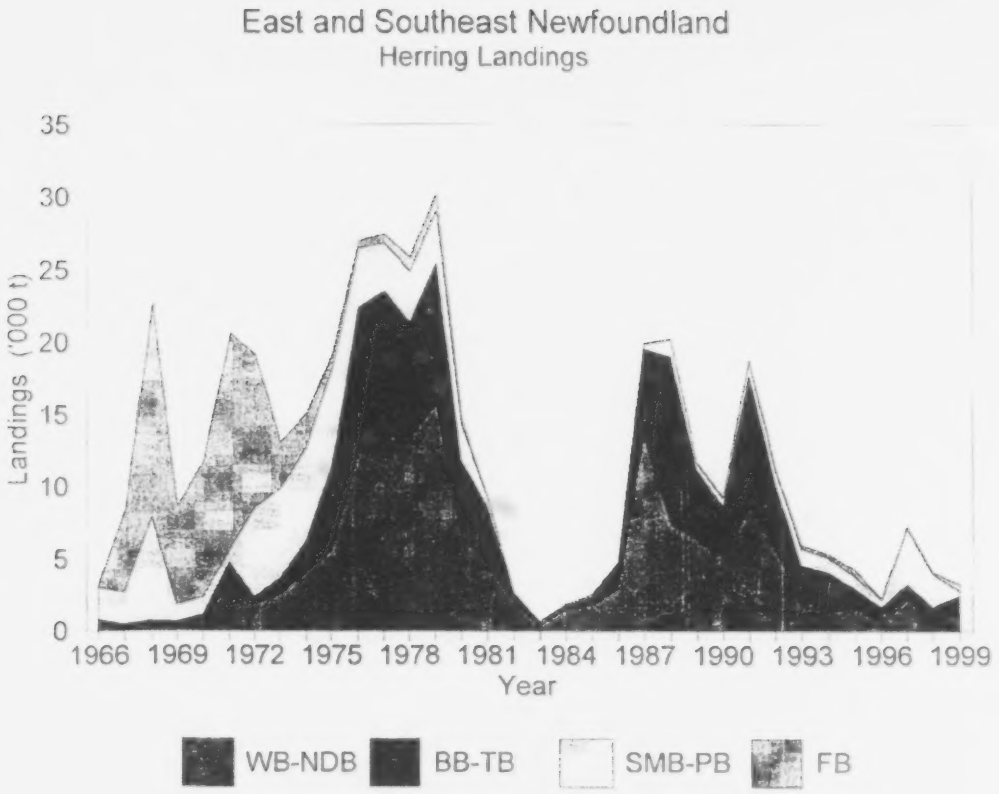


Figure 2. East and southeast Newfoundland herring landings, 1966-99, for White Bay - Notre Dame Bay (WB-NDB), Bonavista Bay - Trinity Bay (BB-TB), St. Mary's Bay - Placentia Bay (SMB-PB), and Fortune Bay (FB).

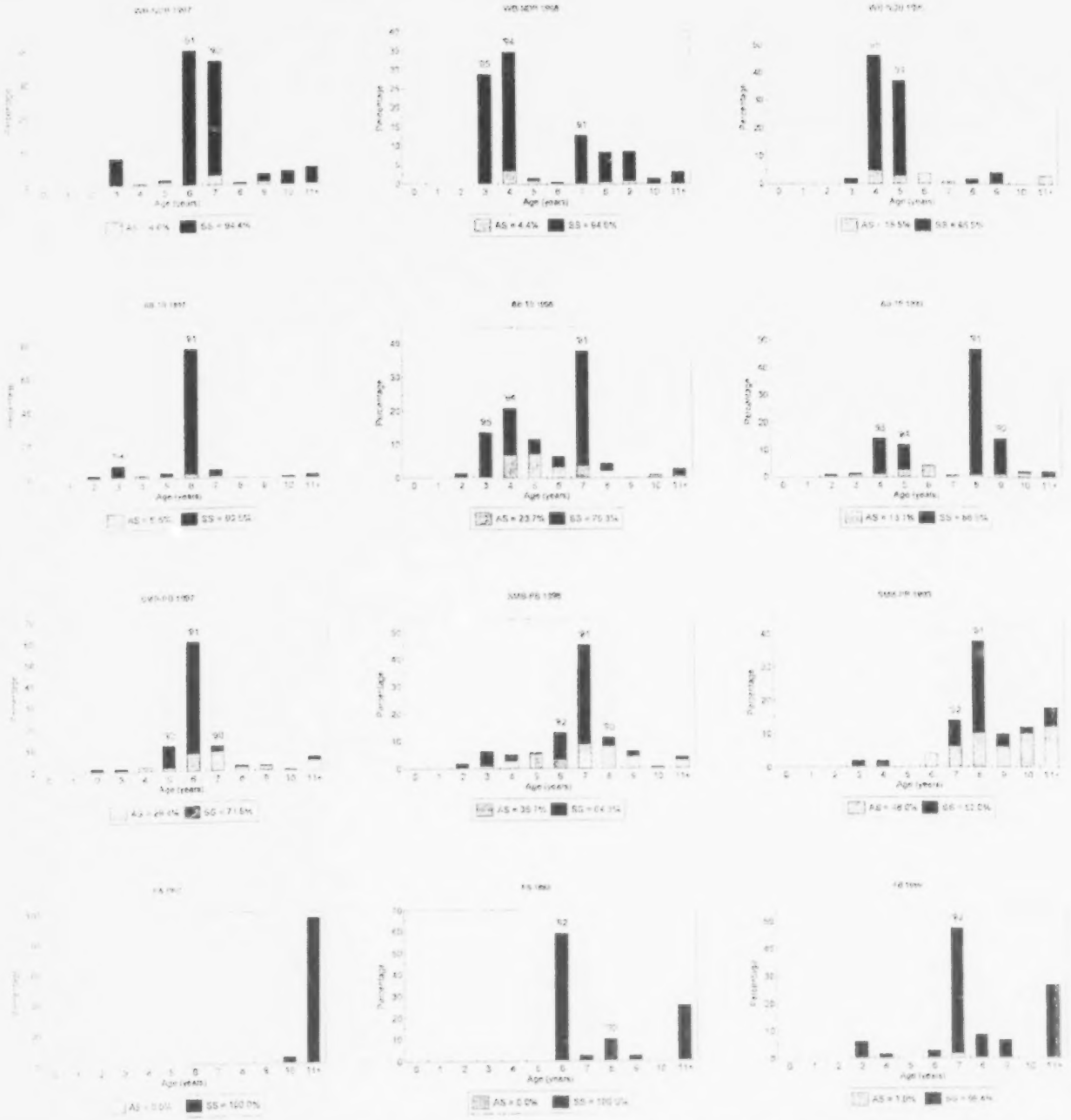


Figure 3. Age distribution of herring from the commercial fishery. White Bay - Notre Dame Bay, Bonavista Bay - Trinity Bay, St. Mary's Bay - Placentia Bay, and Fortune Bay, 1997 - 1999.

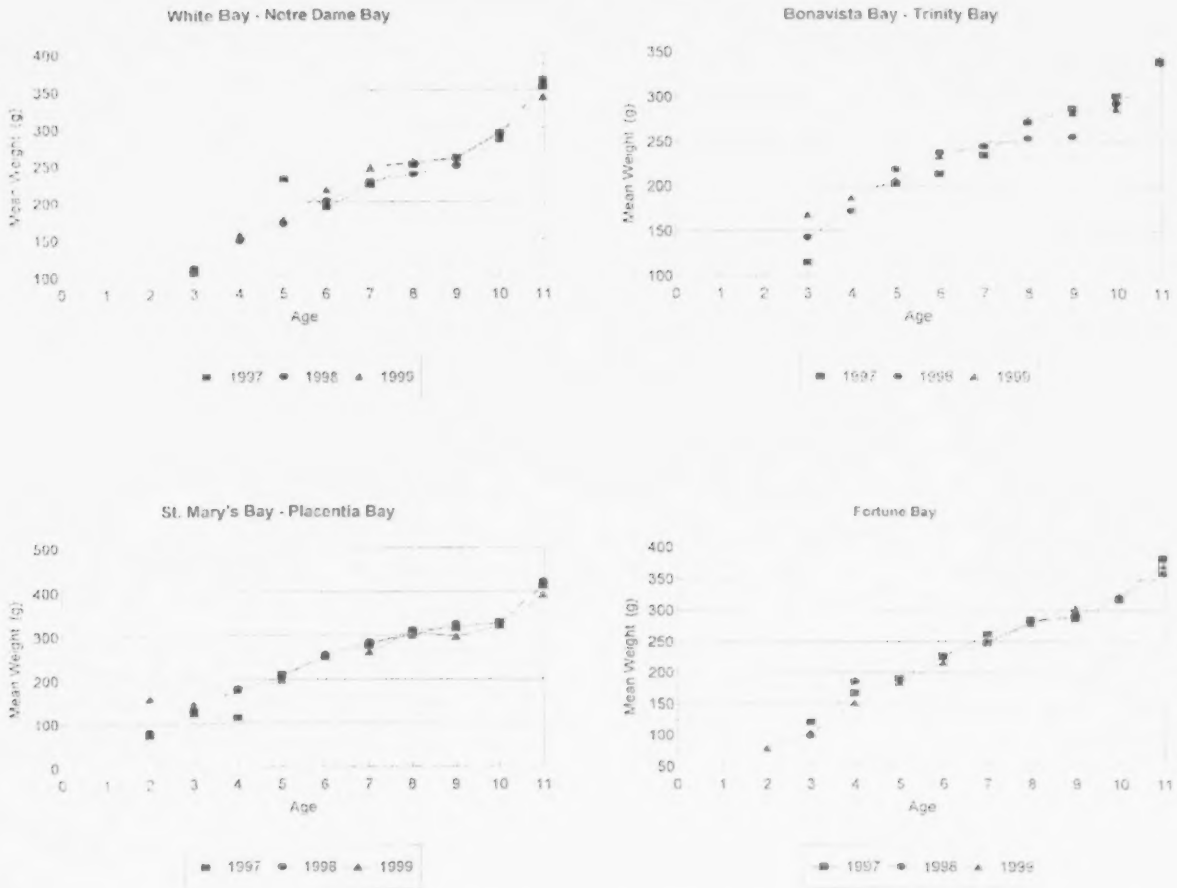


Figure 4. Mean weights at age of spring spawning herring, by stock area, and year, from samples collected Janauary to June.

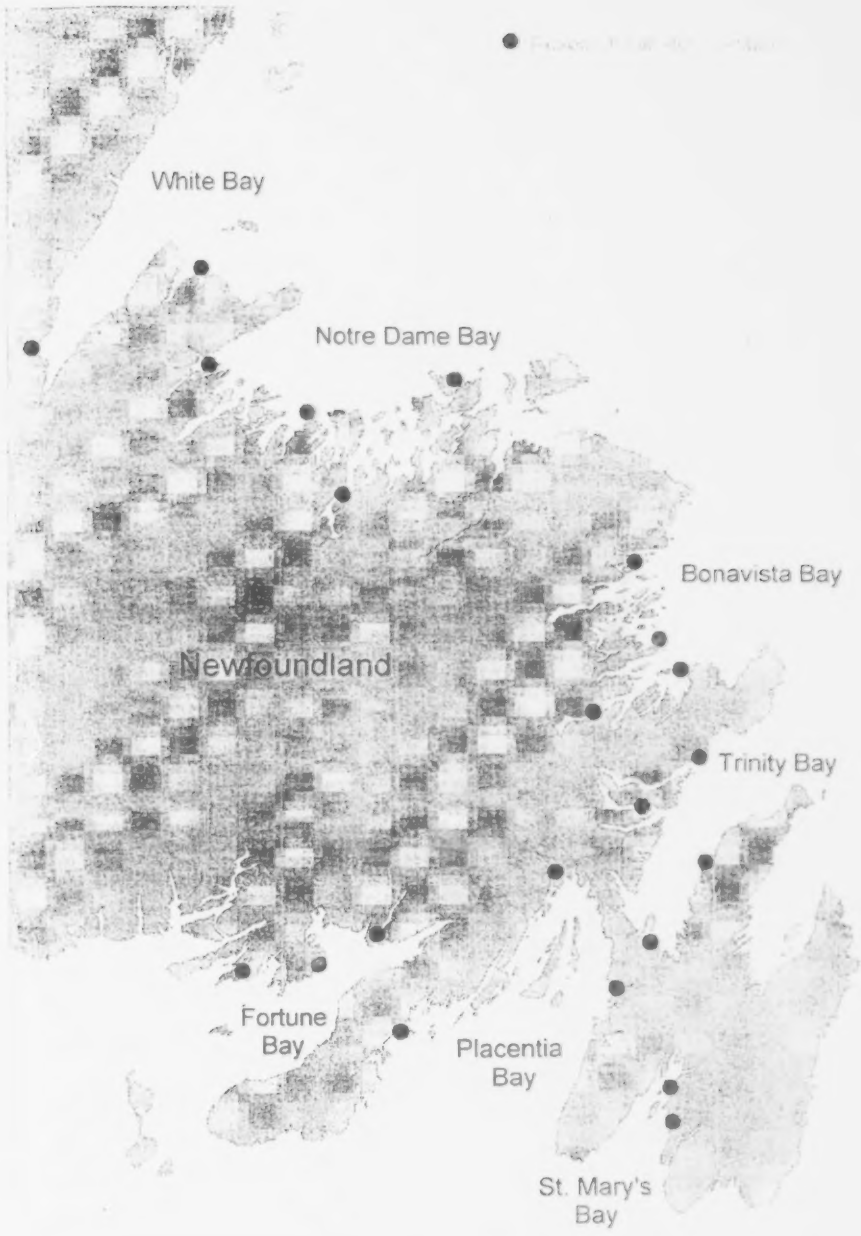


Figure 5. 2000 Newfoundland east and southeast coast herring research gill net set locations.

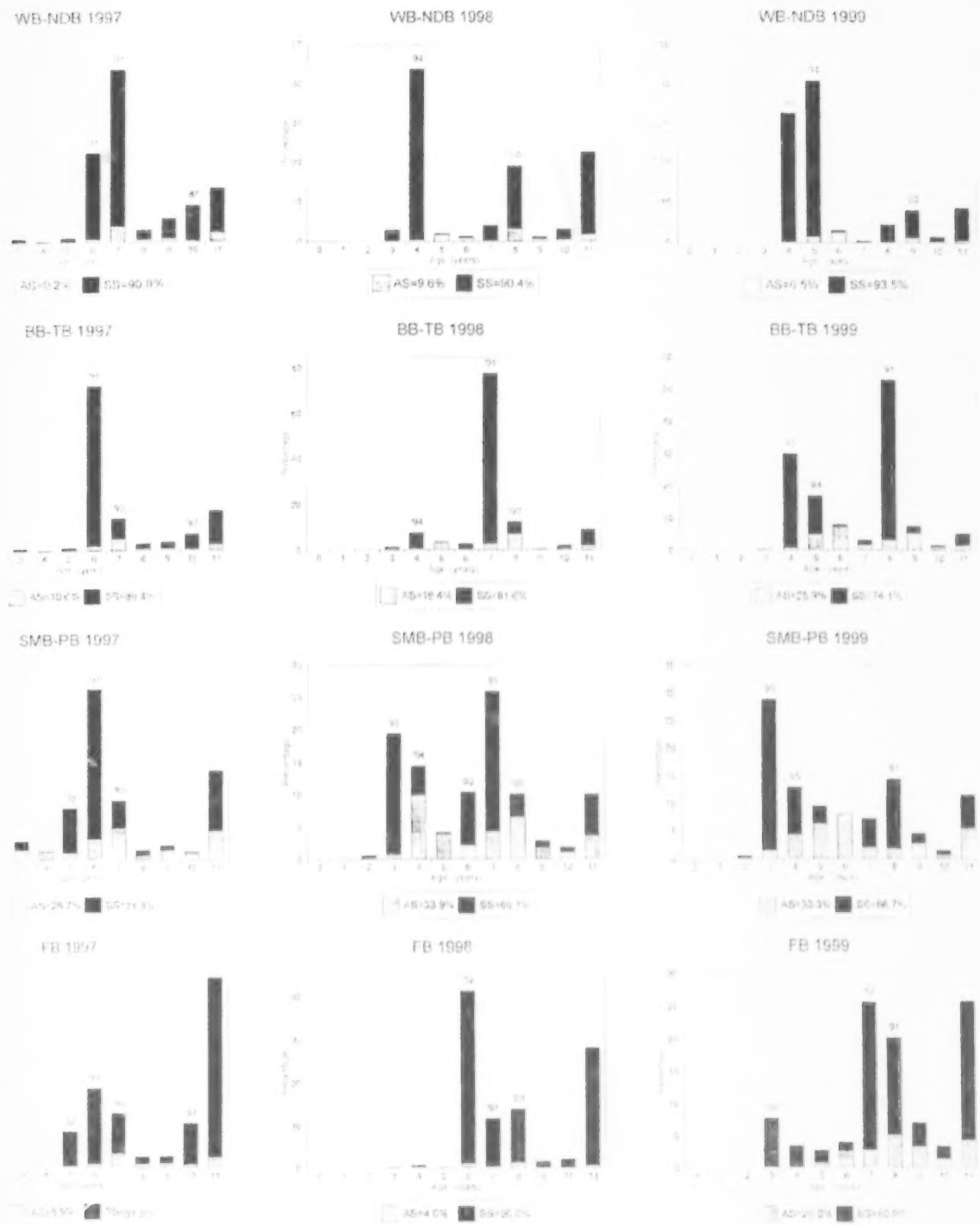


Figure 6. Age distribution (by number) of herring from the spring research gillnet program, White Bay - Notre Dame Bay, Bonavista Bay - Trinity Bay, St. Mary's Bay - Placentia Bay, and Fortune Bay, 1997 - 1999.

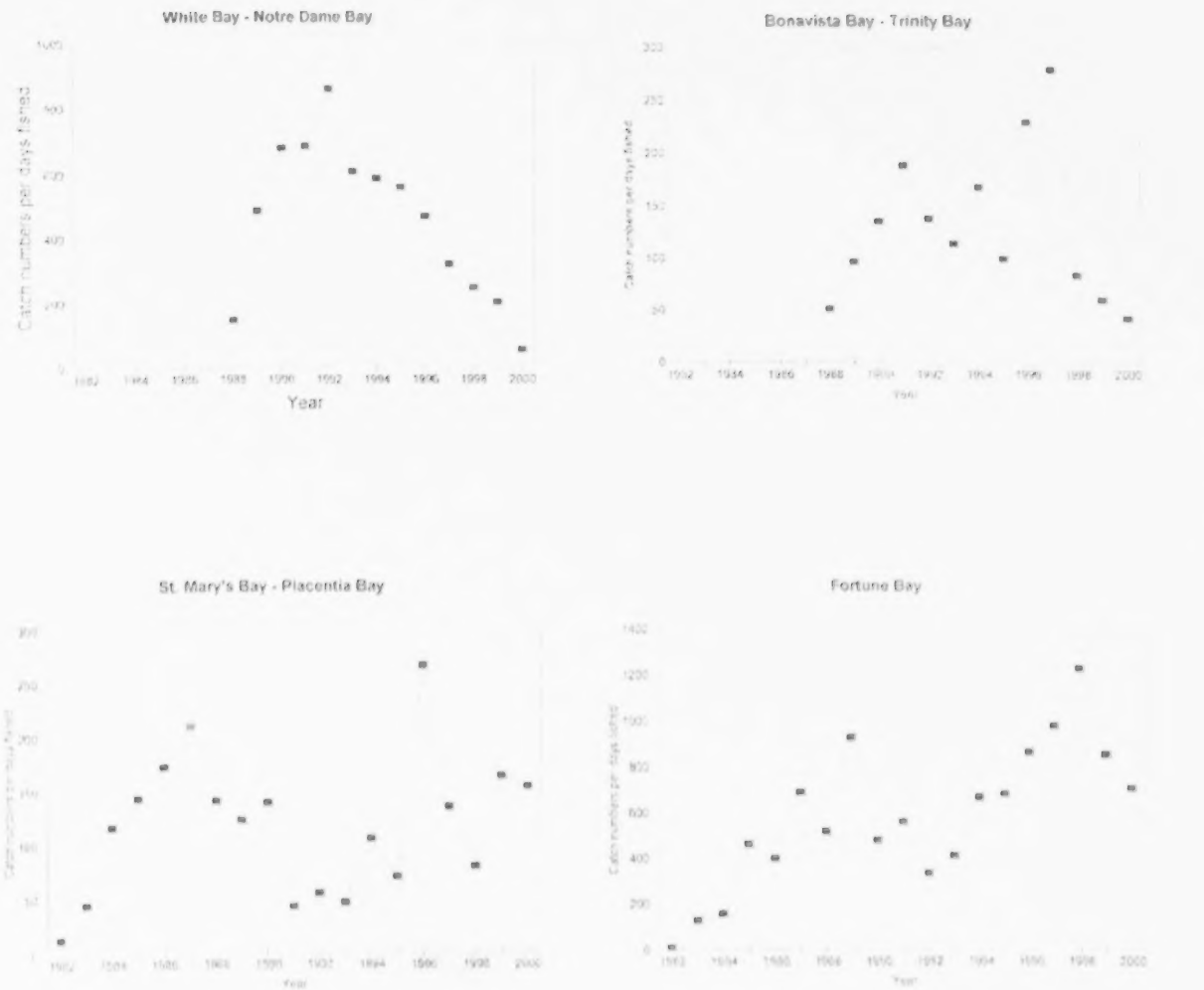

White Bay - Notre Dame Bay
Catch numbers per days fished
Year
Bonavista Bay - Trinity Bay
St. Mary's Bay - Placentia Bay
Fortune Bay

Figure 7. Spring research gillnet catch rates (numbers per days fished), spring spawners only, by stock area and year.

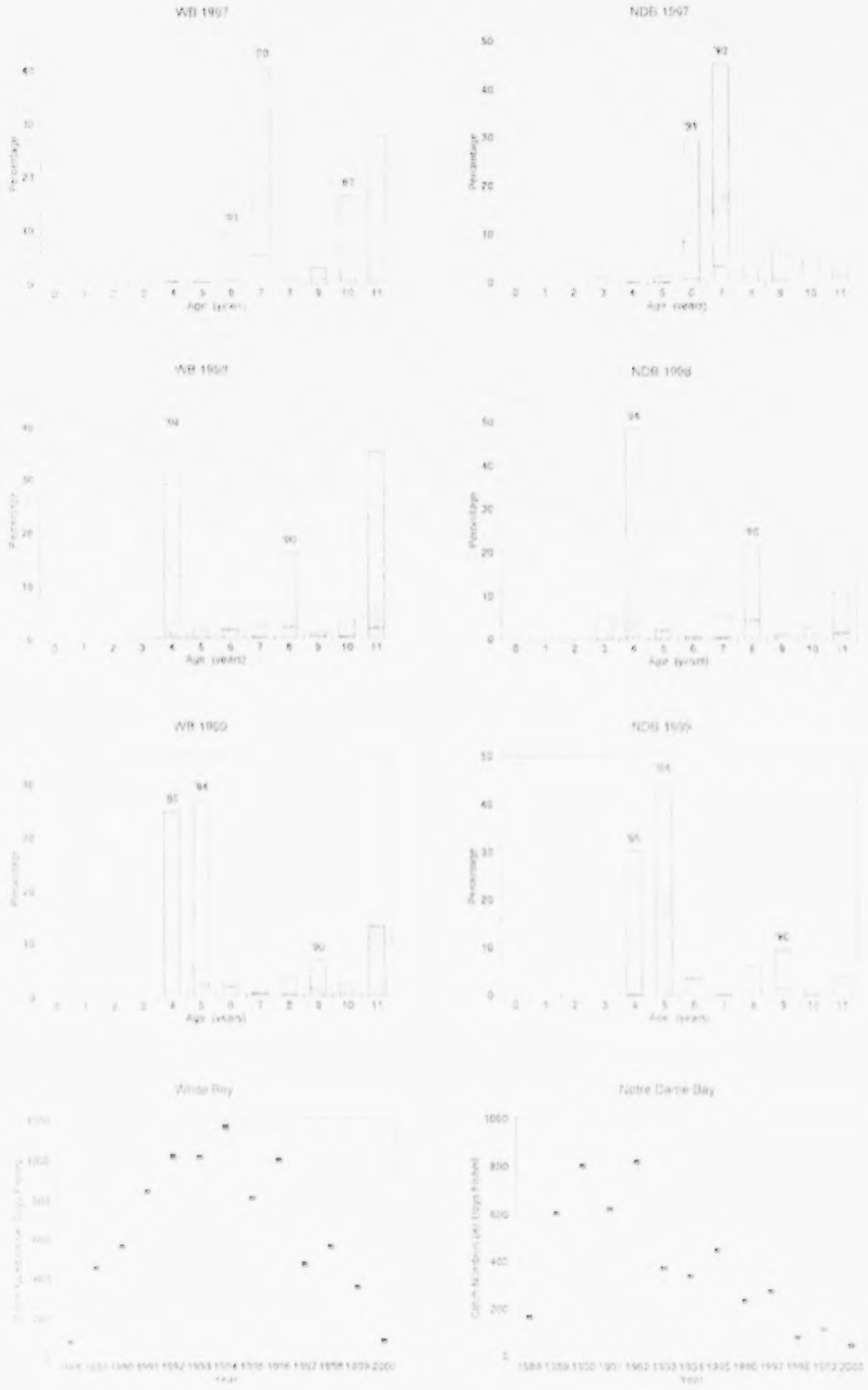


Figure 8. Herring age distributions (by number), 1997-1999, and catch rates (numbers per days fished), 1988-2000, from the spring research gillnet program for White Bay and Notre Dame Bay separately.

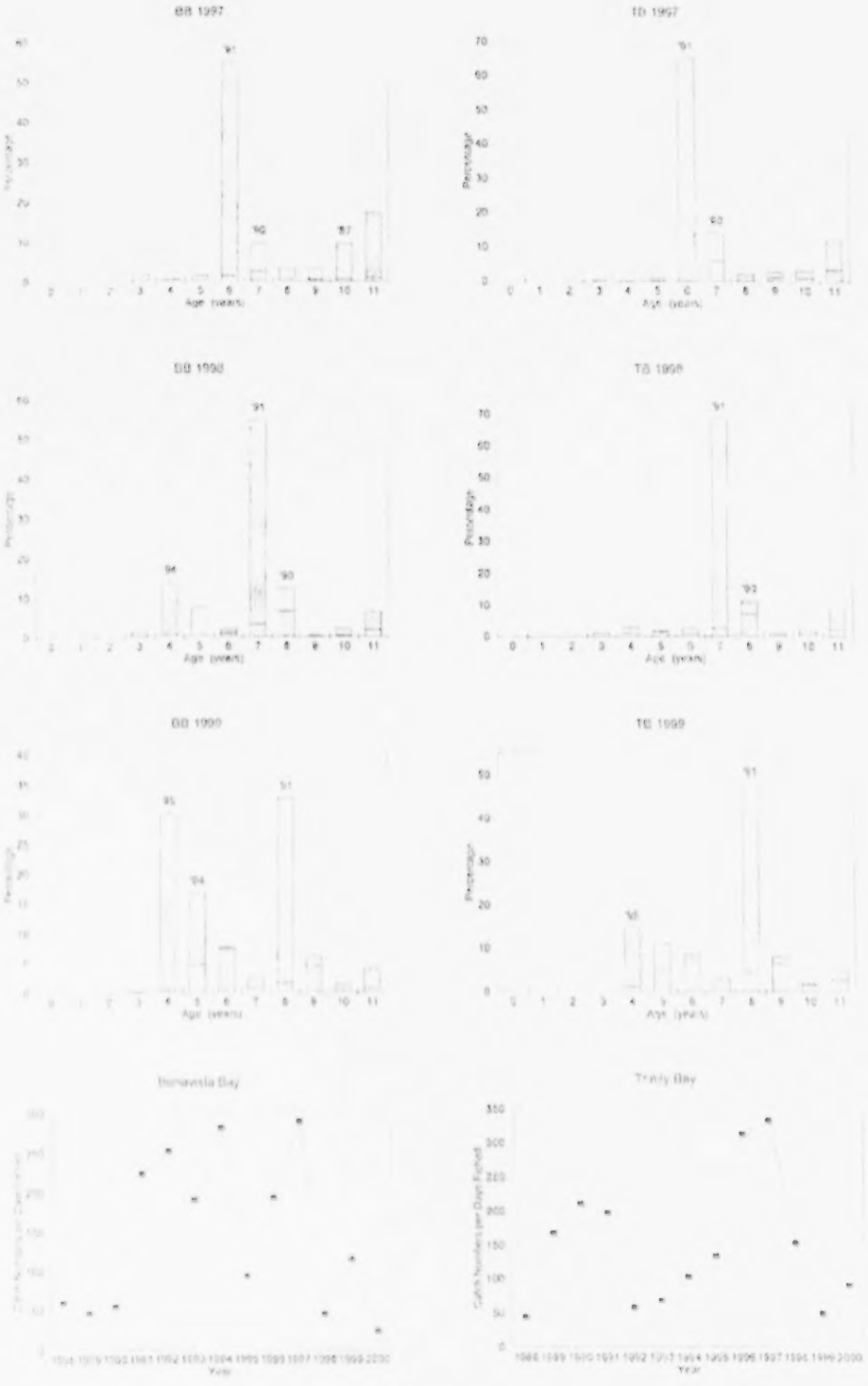


Figure 9. Herring age distributions (by number), 1997-1999, and catch rates (numbers per days fished), 1988-2000, from the spring research gillnet program for Bonavista Bay and Trinity Bay separately.

Figure 10. Herring age distributions (by number), 1997-1999, and catch rates (numbers per days fished), 1982-2000, from the spring research gillnet program for St. Mary's Bay and Placentia Bay separately.

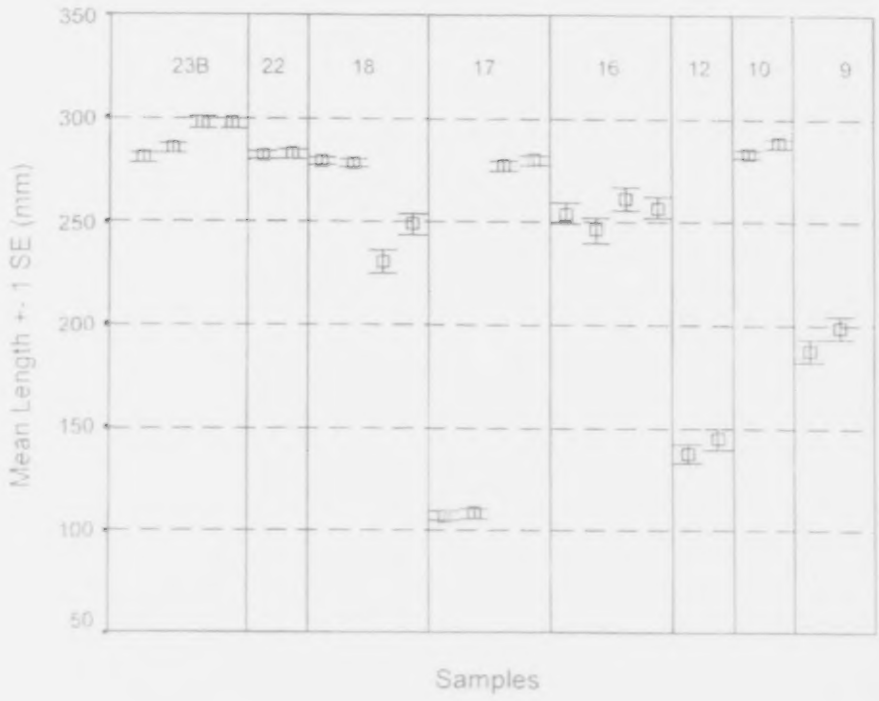


Figure 11. Mean fish lengths (mm) by sample and stratum, from the 1998 White Bay - Notre Dame Bay acoustic survey.

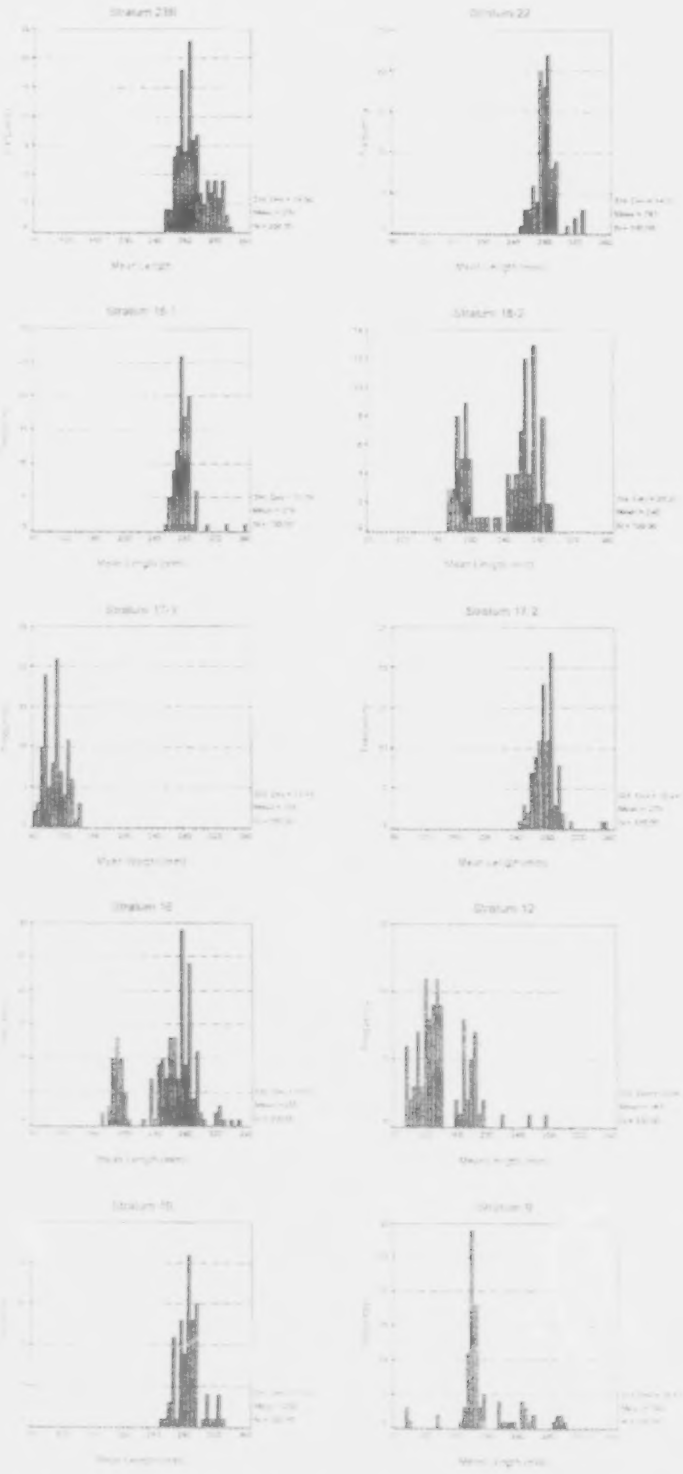


Figure 12. Length distributions of biological samples, by stratum, from the 1998 White Bay - Notre Dame Bay acoustic survey.

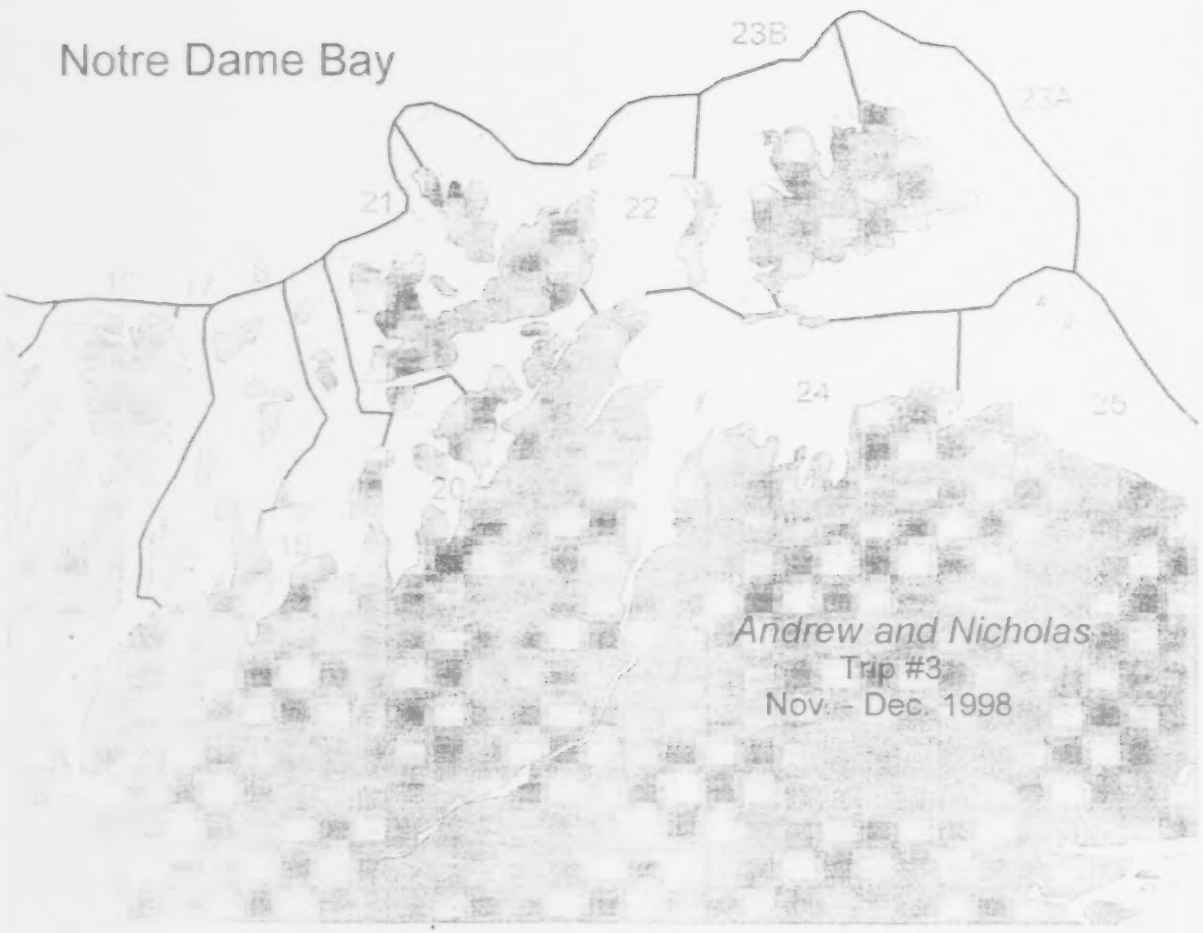


Figure 13. Area map of Notre Dame Bay indicating survey strata and transects for the 1998 inshore acoustic survey.

Figure 13. Area map of Notre Dame Bay indicating survey strata and transects for the 1998 inshore acoustic survey.

Figure 14. Area map of White Bay and Green Bay indicating survey strata and transects for the 1998 inshore acoustic survey.

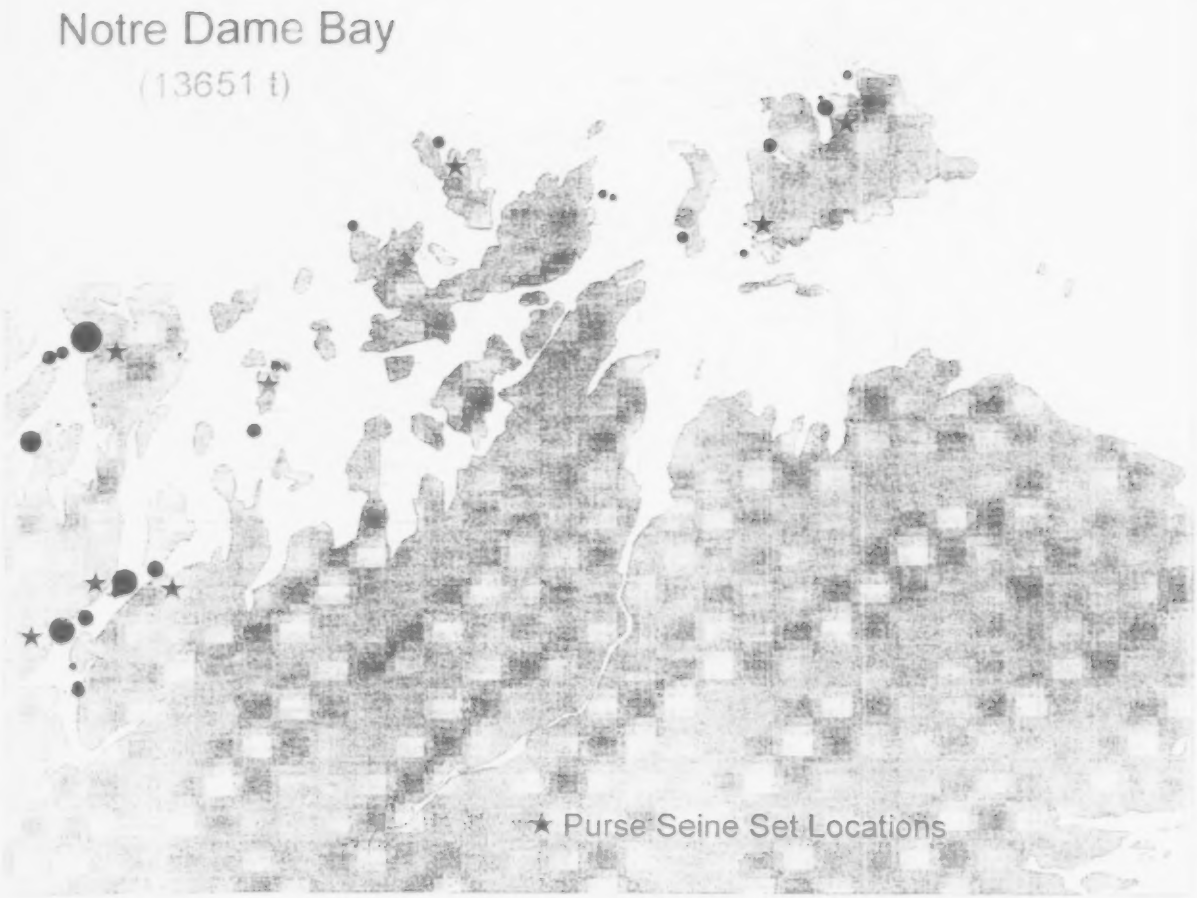


Figure 15. Distribution and density of herring on transects during the 1998 inshore acoustic survey of White Bay - Notre Dame Bay. Relative densities of herring are represented by expanding black symbols.

Figure 14. Area map of White Bay and Green Bay indicating survey strata and transects for the 1998 inshore acoustic survey.

Figure 15. Distribution and density of herring on transects during the 1998 inshore acoustic survey of White Bay - Notre Dame Bay. Relative densities of herring are represented by expanding black symbols.

Figure 16. Distribution and density of herring on transects during the 1998 inshore acoustic survey of White Bay - Notre Dame Bay. Relative densities of herring are represented by expanding black symbols.

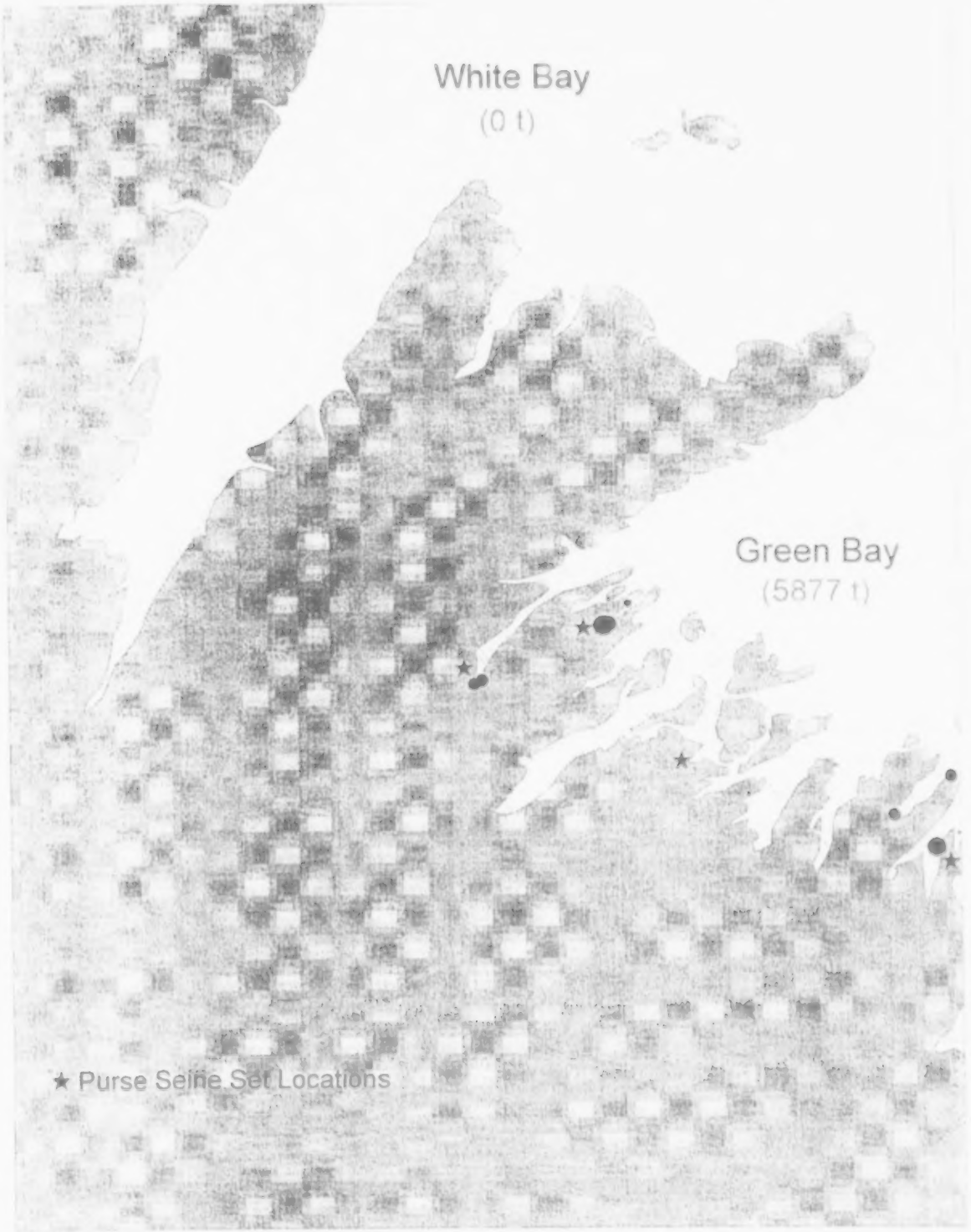
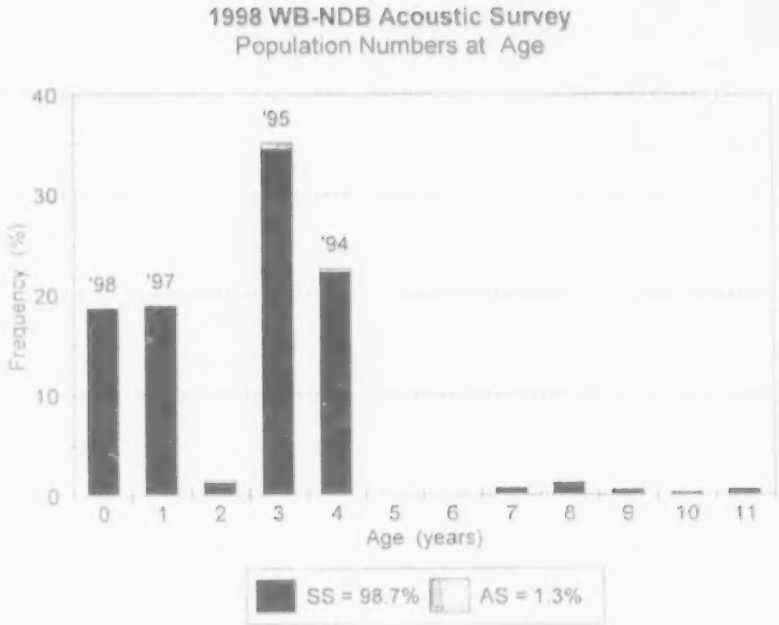


Figure 16. Distribution and density of herring on transects during the 1998 inshore acoustic survey of White Bay - Notre Dame Bay. Relative densities of herring are represented by expanding black symbols.



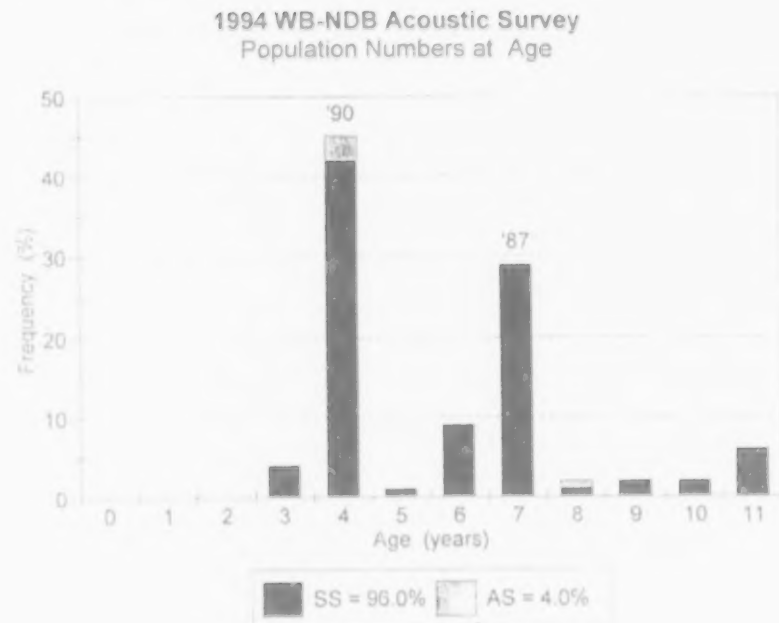


Figure 17 Age distributions of herring from the 1998 and 1994 White Bay - Notre Dame Bay acoustic surveys.

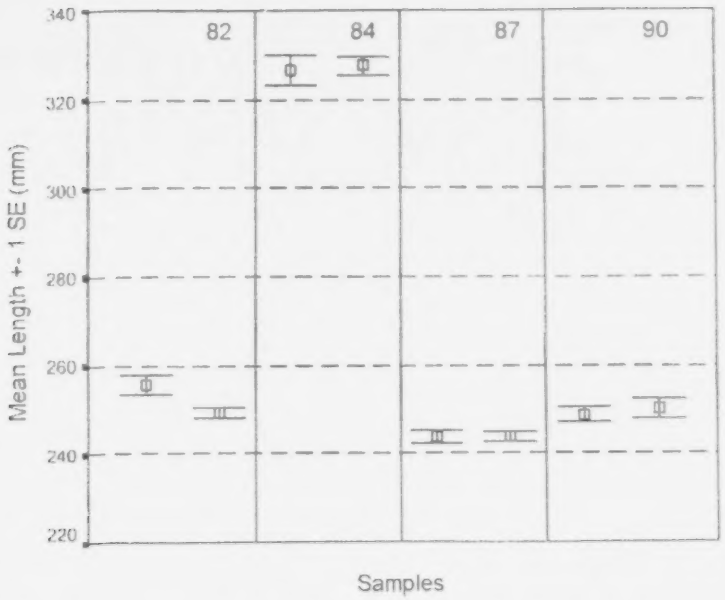


Figure 18. Mean fish lengths (mm) by sample and stratum, from the 1999 Fortune Bay acoustic survey.

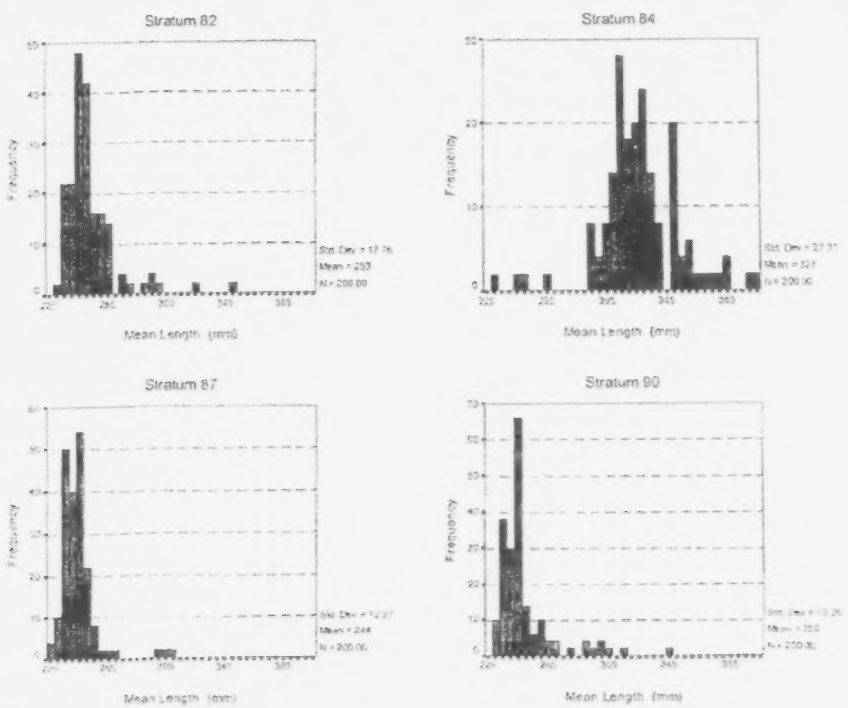


Figure 19. Length distributions of biological samples, by stratum, from the 1999 Fortune Bay acoustic survey.

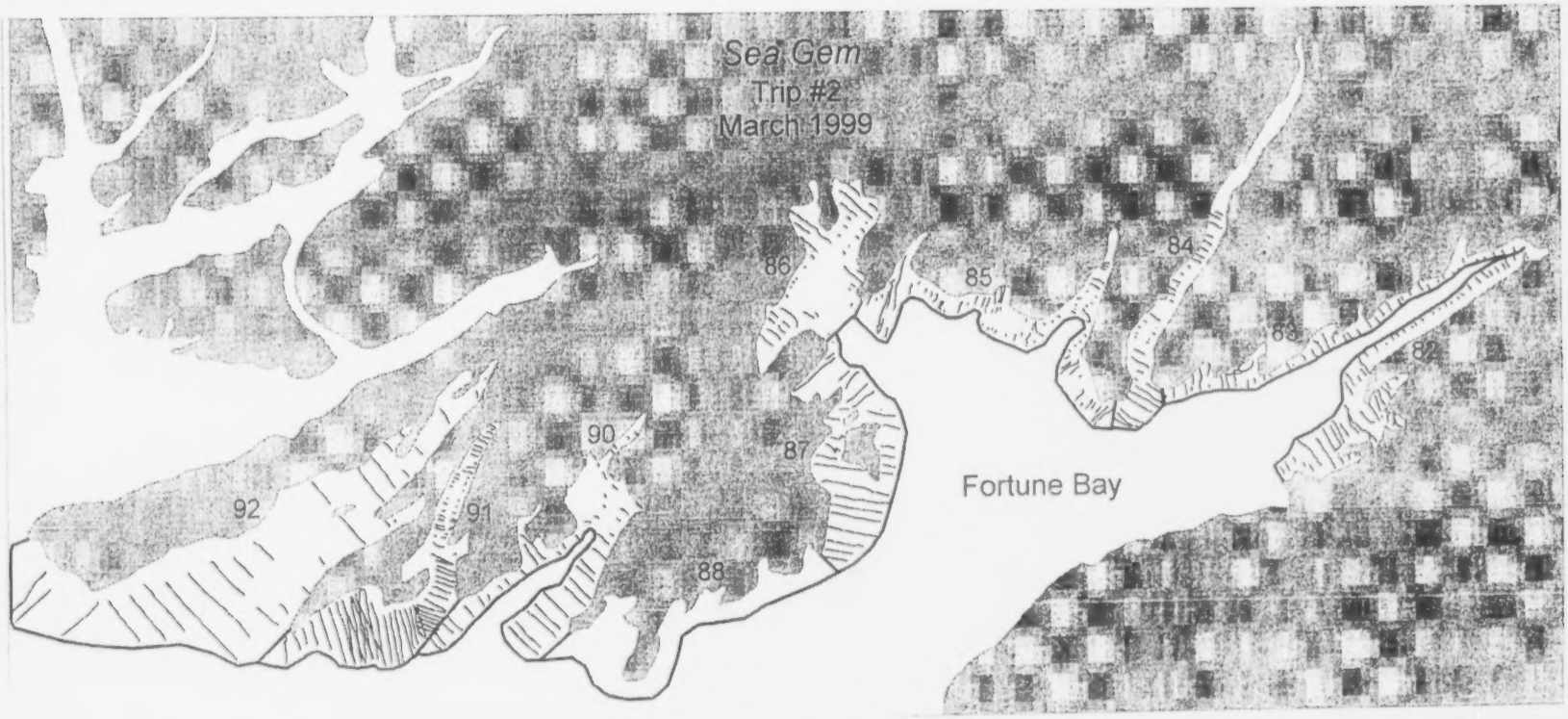


Figure 20. Area map of Fortune Bay indicating survey strata and transects for the 1999 inshore acoustic survey.

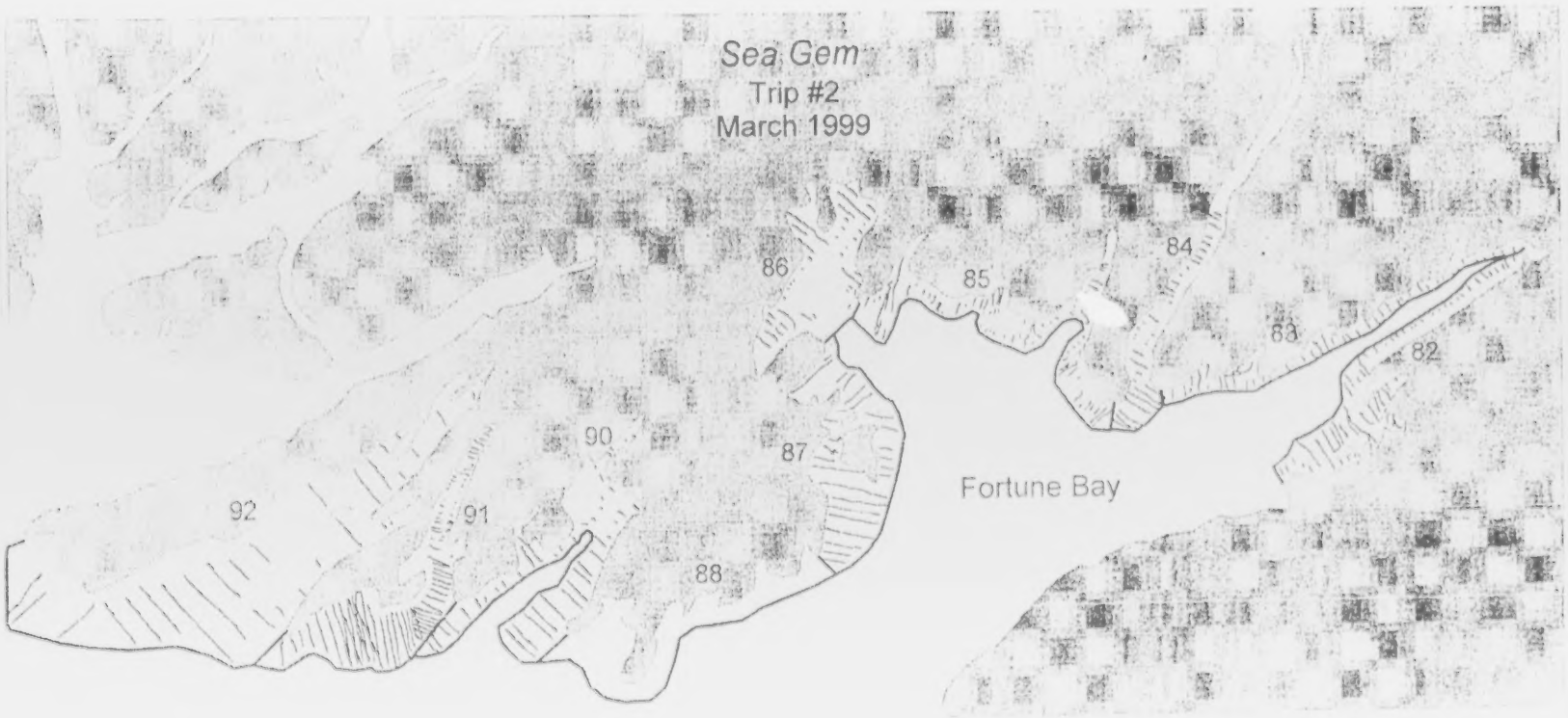


Figure 20. Area map of Fortune Bay indicating survey strata and transects for the 1999 inshore acoustic survey.

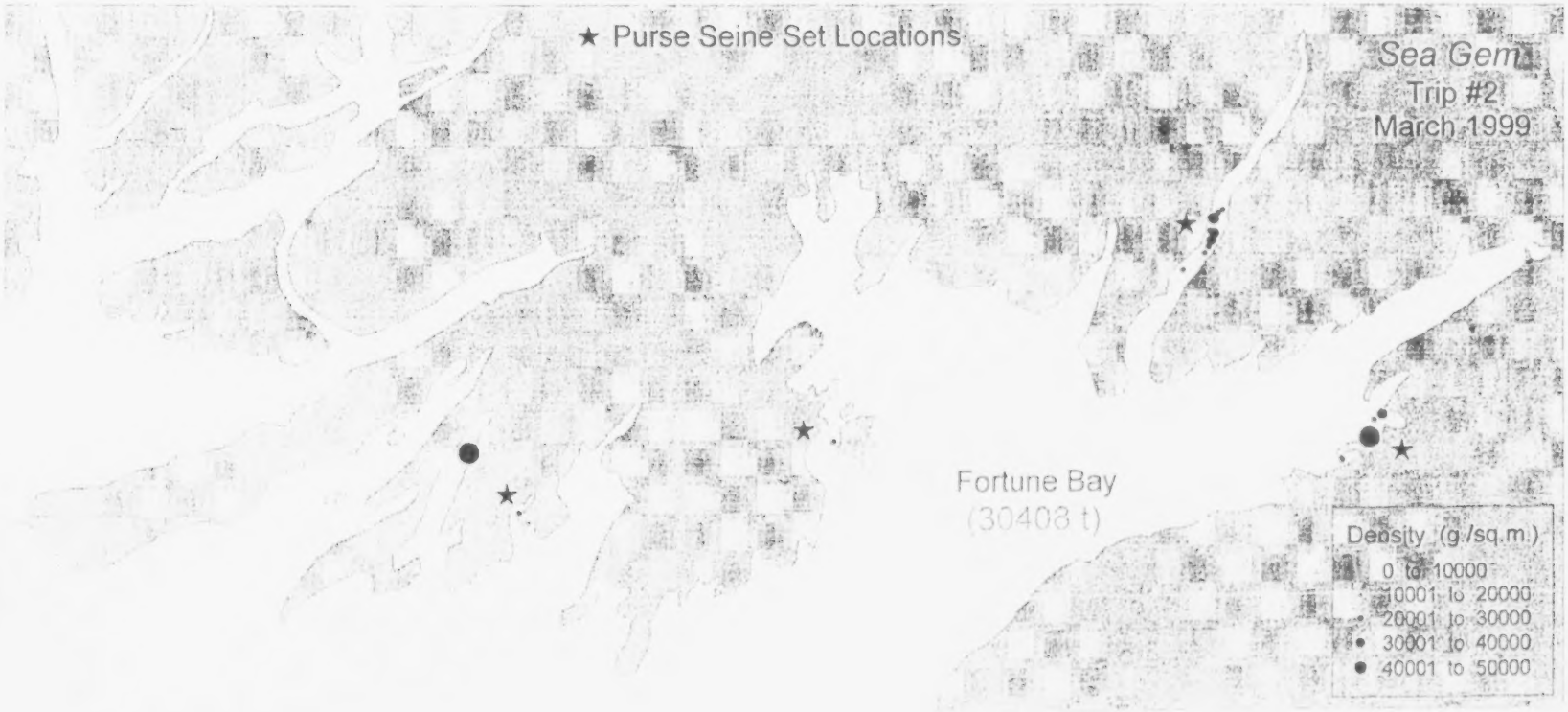


Figure 21. Distribution and density of herring on transects during the 1999 inshore acoustic survey of Fortune Bay. Relative densities of herring are represented by expanding black symbols.

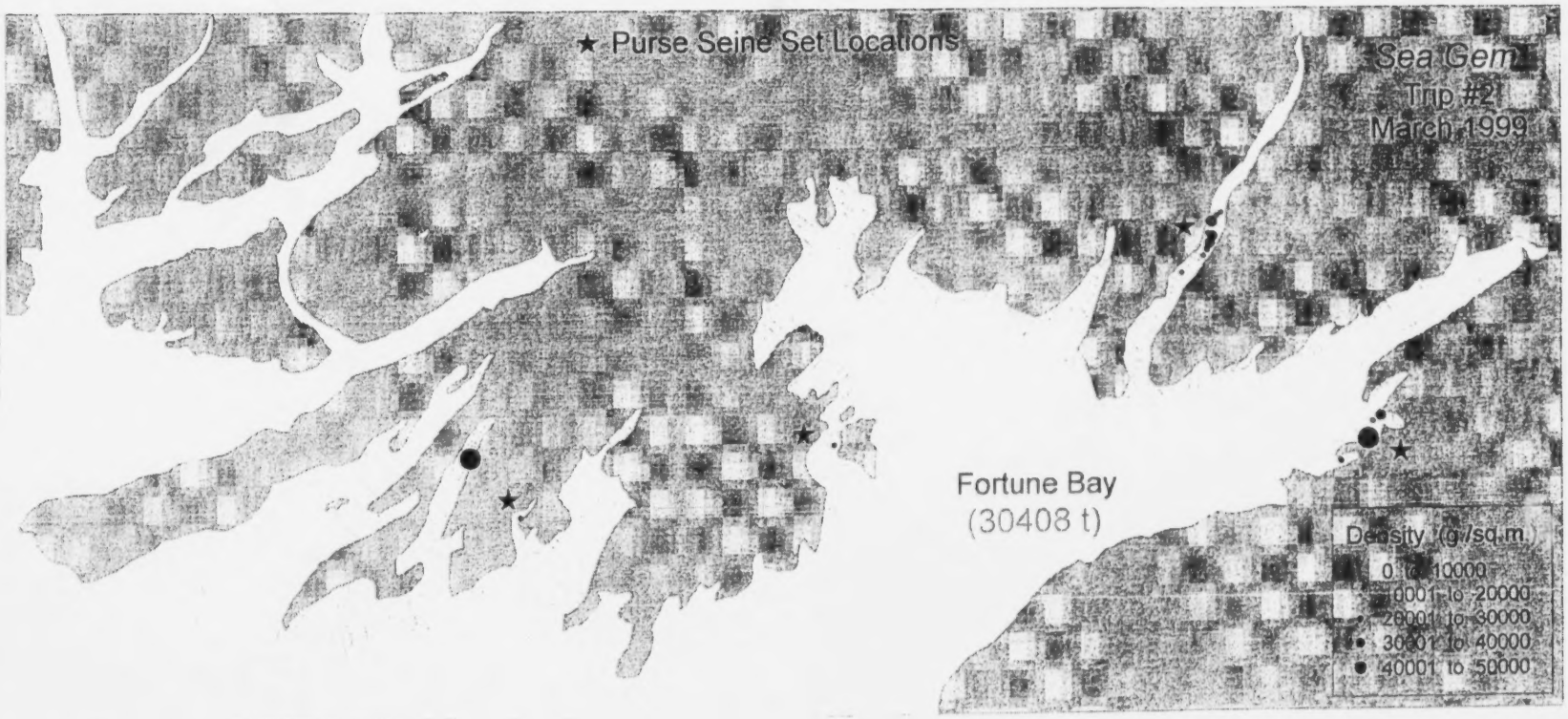


Figure 21. Distribution and density of herring on transects during the 1999 inshore acoustic survey of Fortune Bay. Relative densities of herring are represented by expanding black symbols.

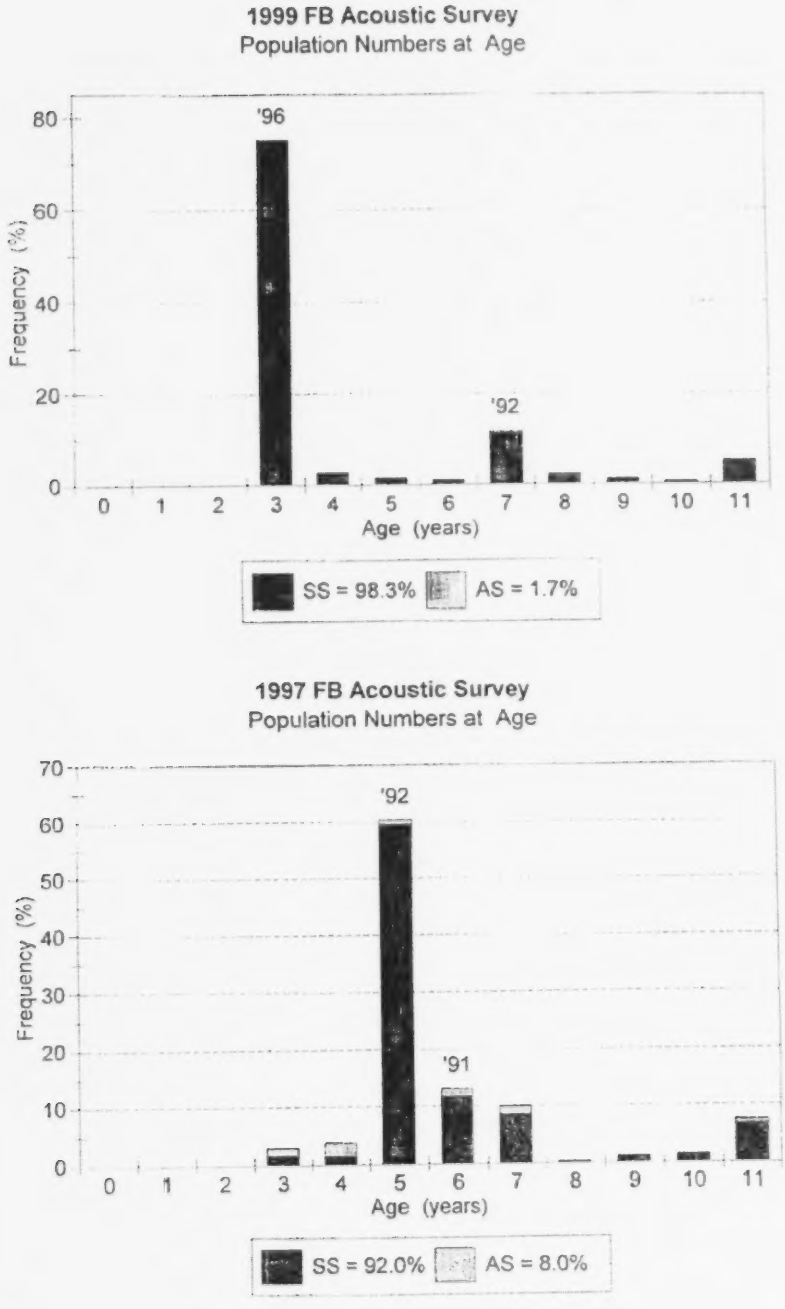


Figure 22. Age distributions of herring from the 1999 and 1997 Fortune Bay acoustic survey

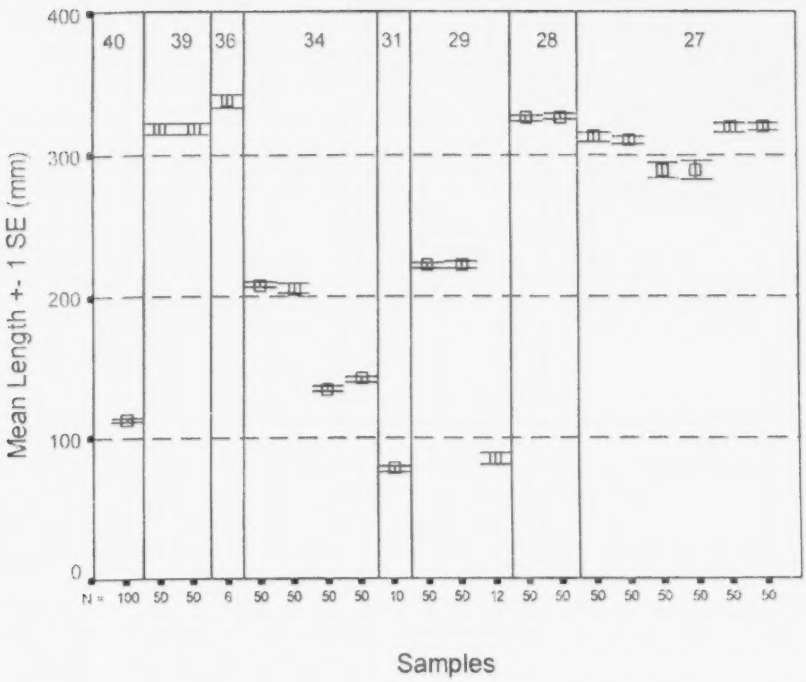


Figure 23. Mean fish lengths (mm) by sample and stratum, from the 1999 Bonavista Bay - Trinity Bay acoustic survey.

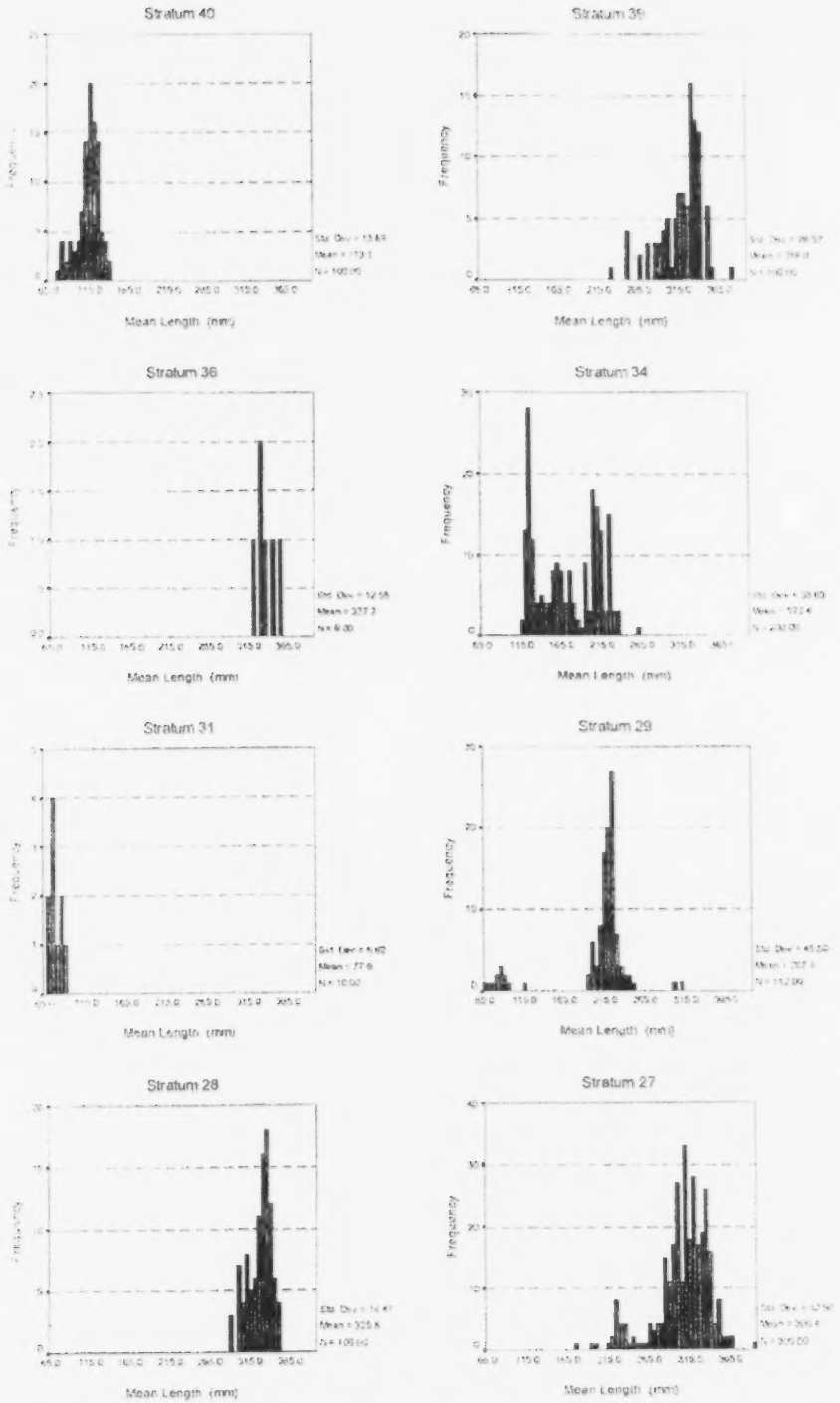


Figure 24. Length distributions of biological samples, by stratum, from the 1999 Bonavista Bay - Trinity Bay acoustic survey.

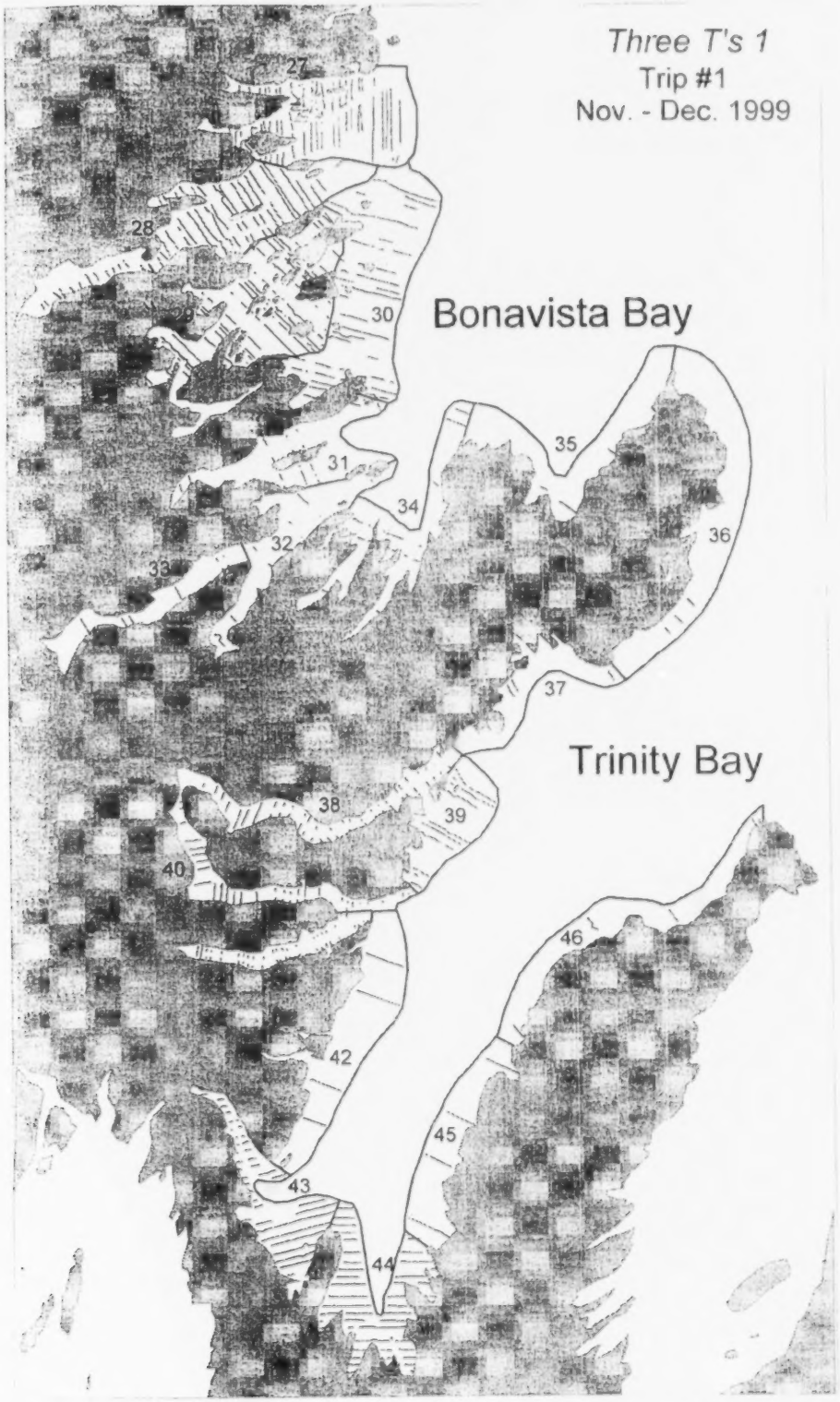


Figure 25. Area map of Bonavista Bay - Trinity Bay indicating survey strata and transects for the 1999 inshore acoustic survey.

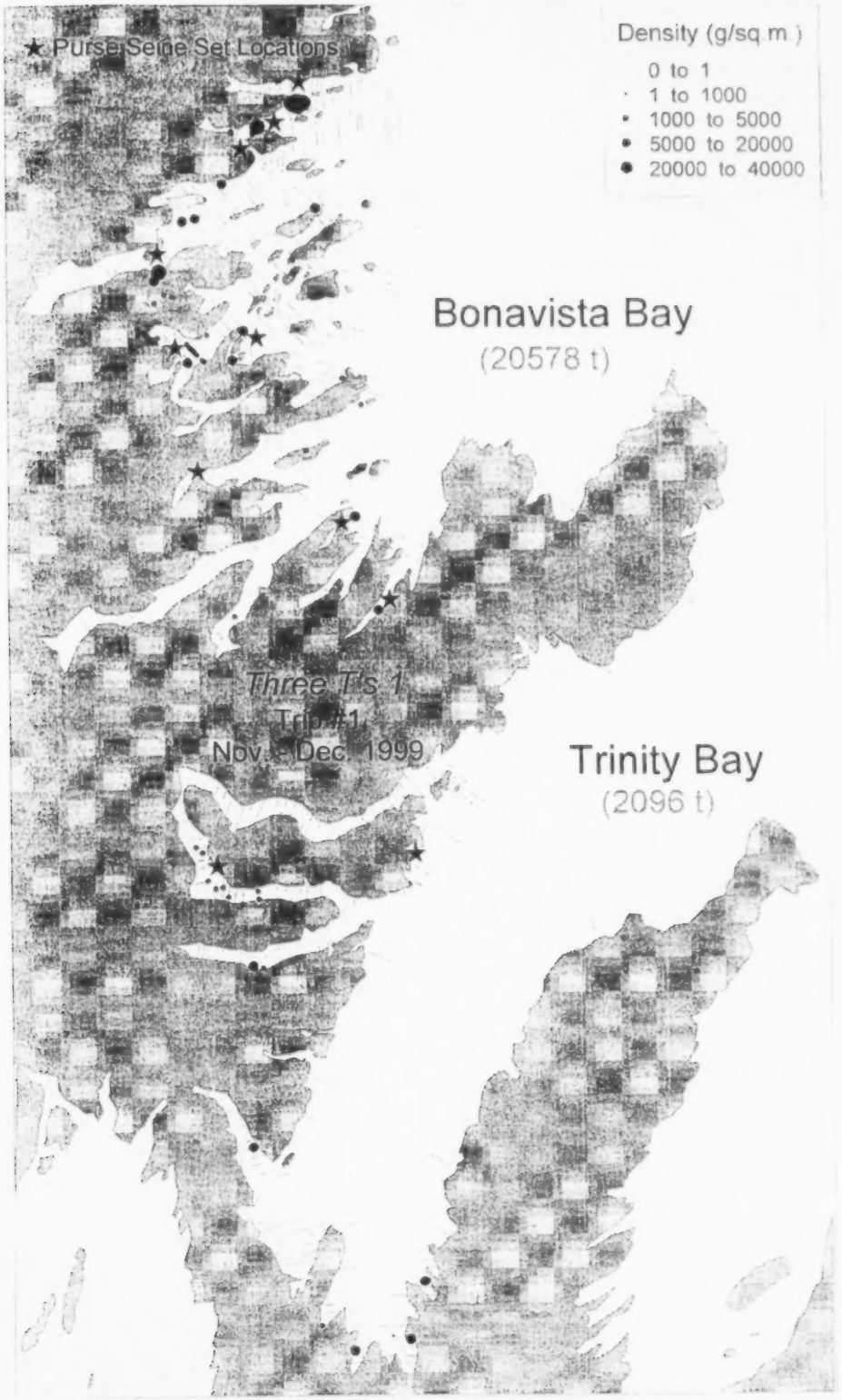


Figure 26. Distribution and density of herring on transects during the 1999 inshore acoustic survey of Bonavista Bay - Trinity Bay. Relative densities of herring are represented by expanding black symbols.

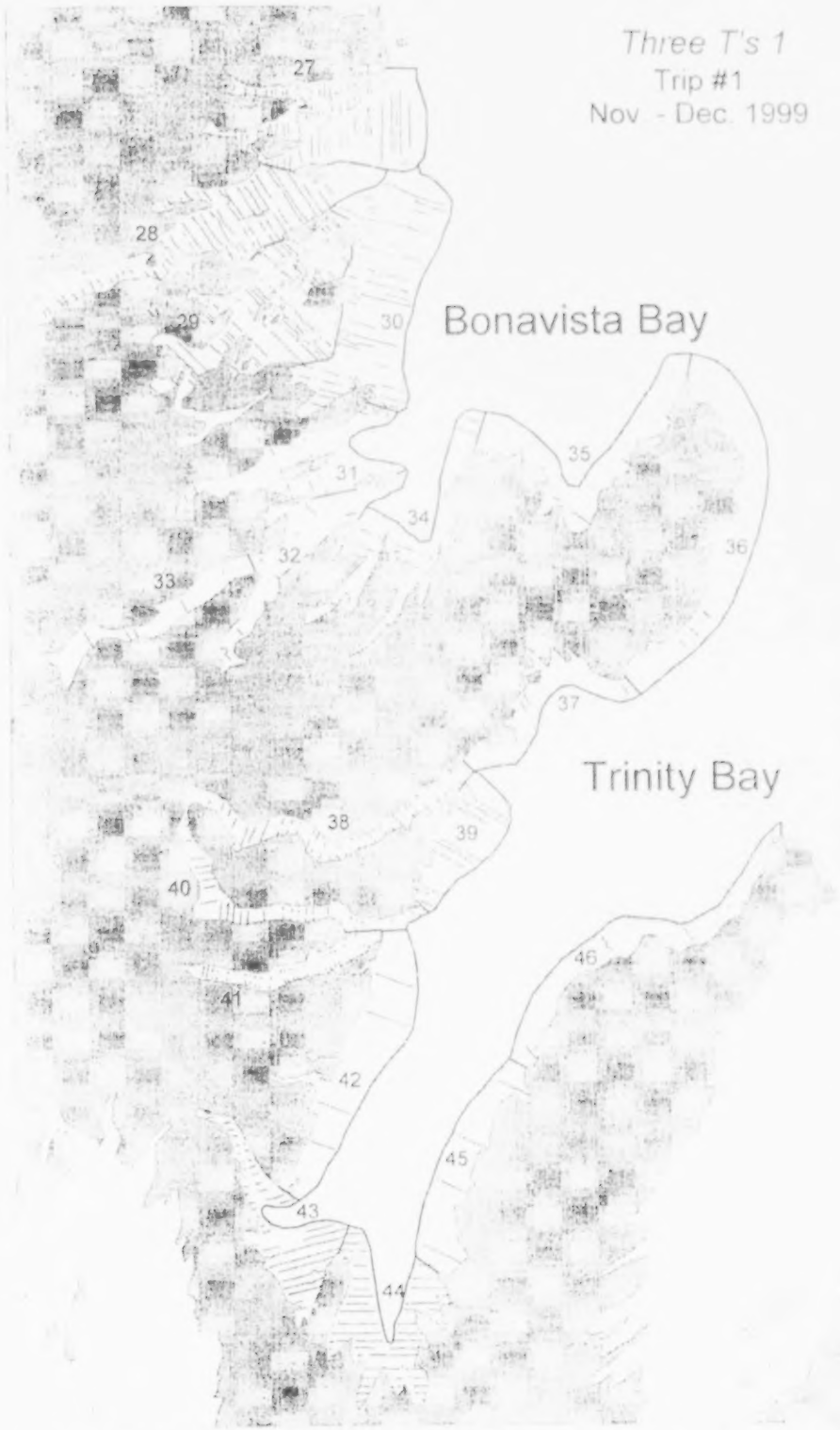


Figure 25. Area map of Bonavista Bay - Trinity Bay indicating survey strata and transects for the 1999 inshore acoustic survey.

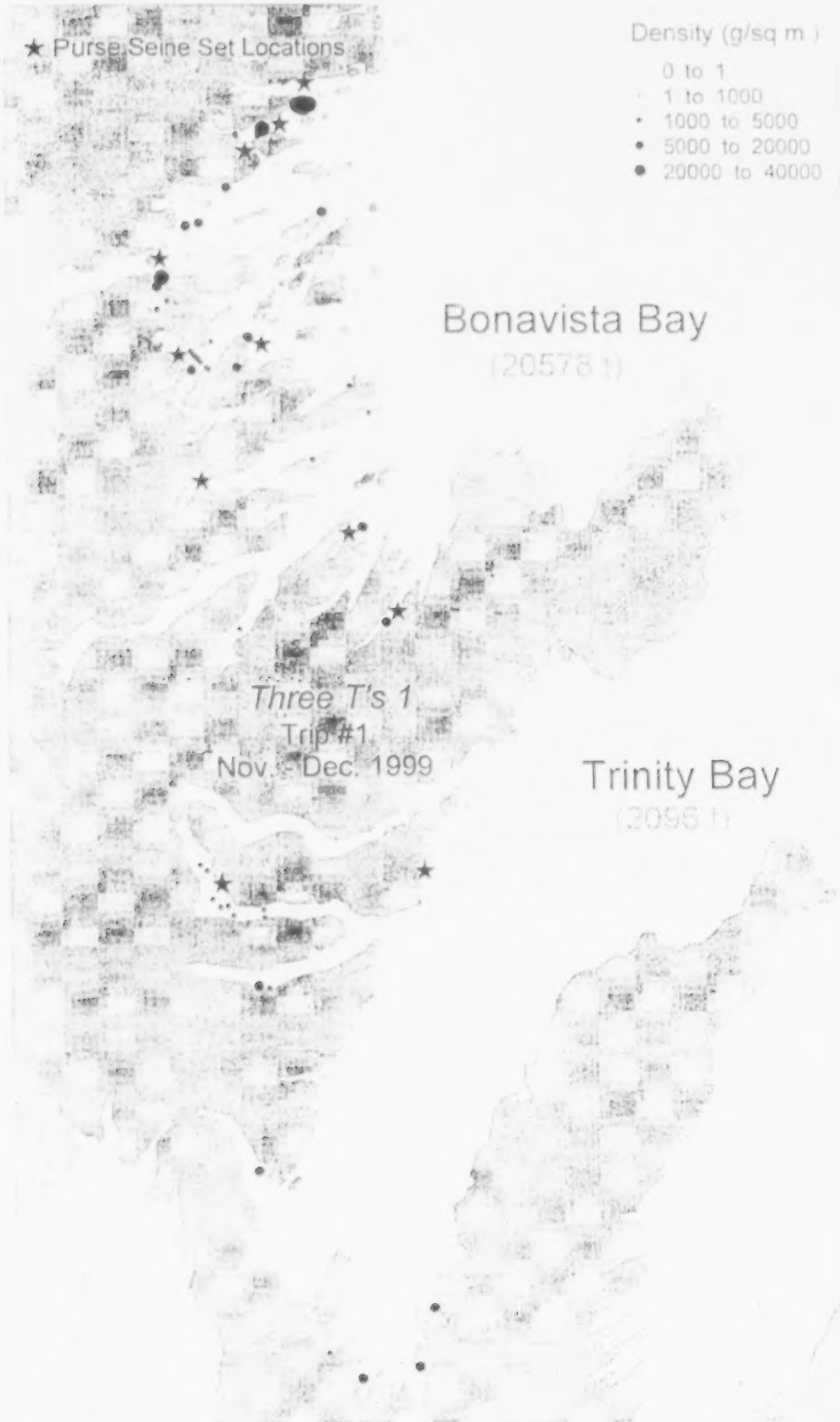
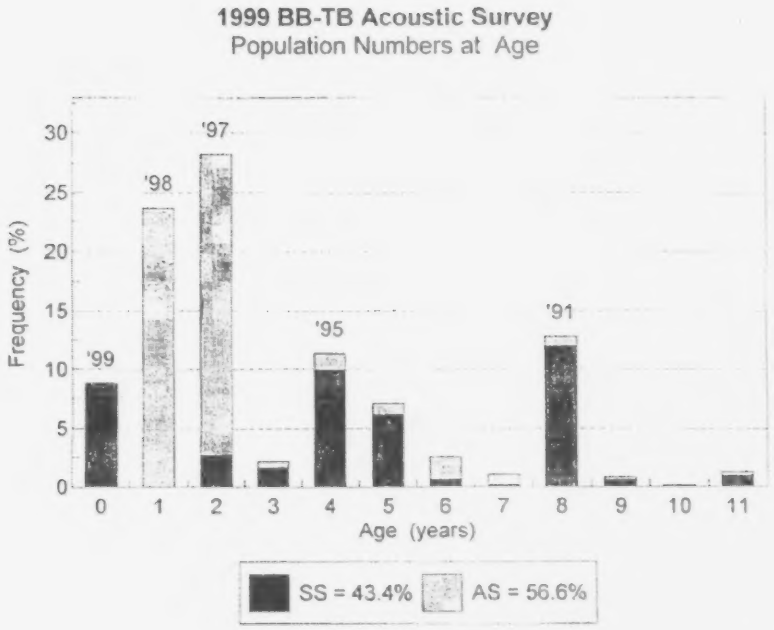


Figure 26. Distribution and density of herring on transects during the 1999 inshore acoustic survey of Bonavista Bay - Trinity Bay. Relative densities of herring are represented by expanding black symbols.



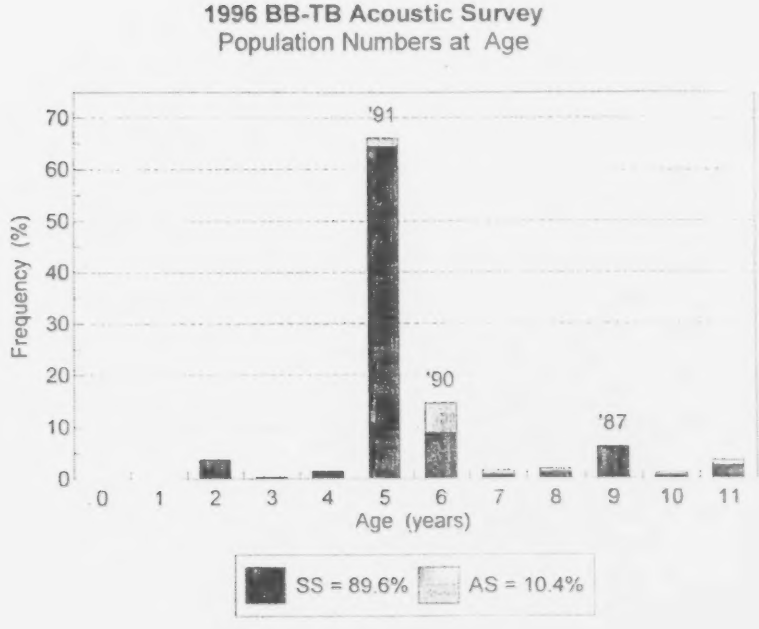


Figure 27. Age distributions of herring from the 1999 and 1996 Bonavista Bay - Trinity Ba acoustic surveys.

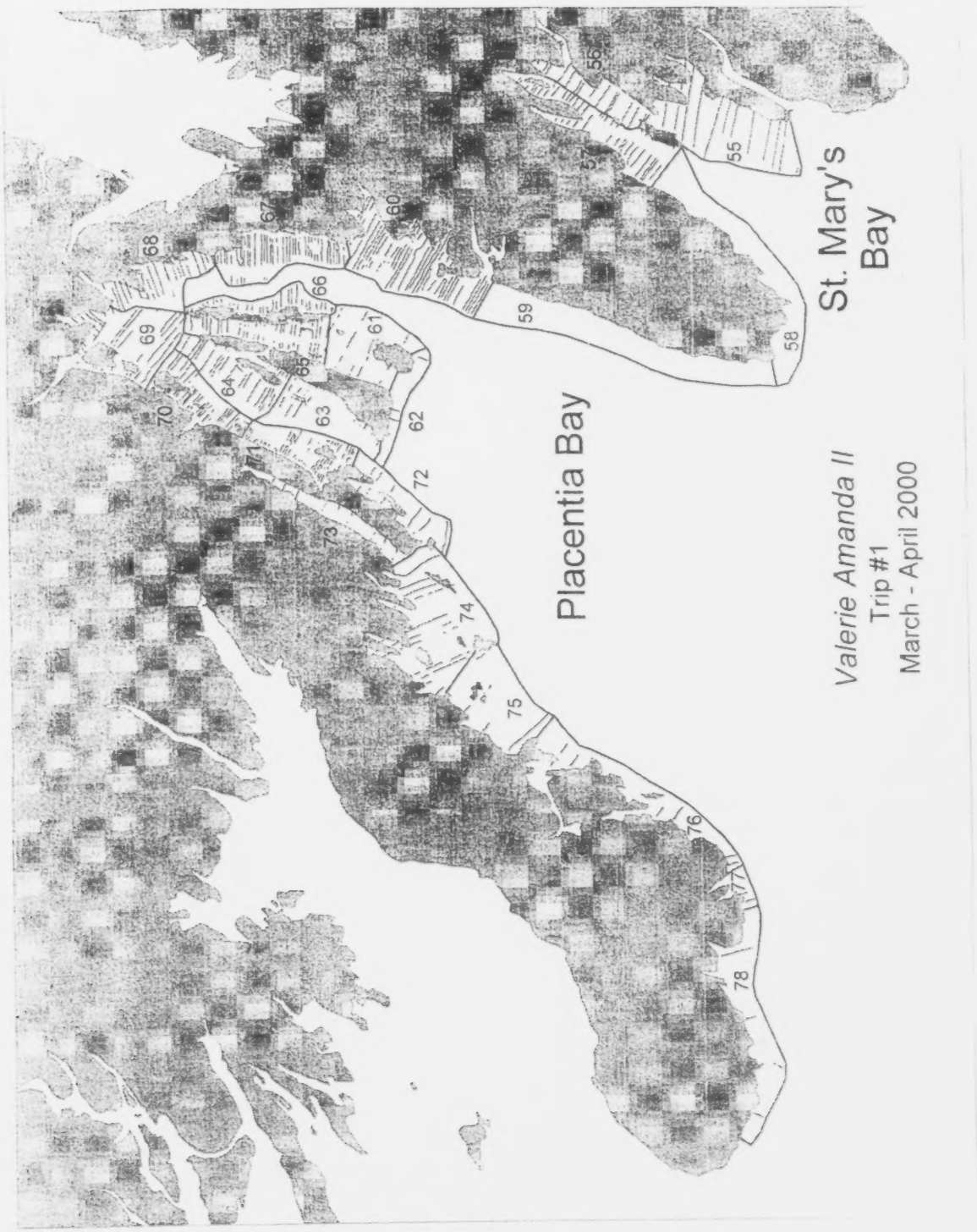


Figure 28. Area map of St. Mary's Bay - Placentia Bay indicating survey strata and transects for the 2000 inshore acoustic survey.

Figure 28. Area map of St. Mary's Bay - Placentia Bay indicating survey strata and transects for the 2000 inshore acoust c survey.

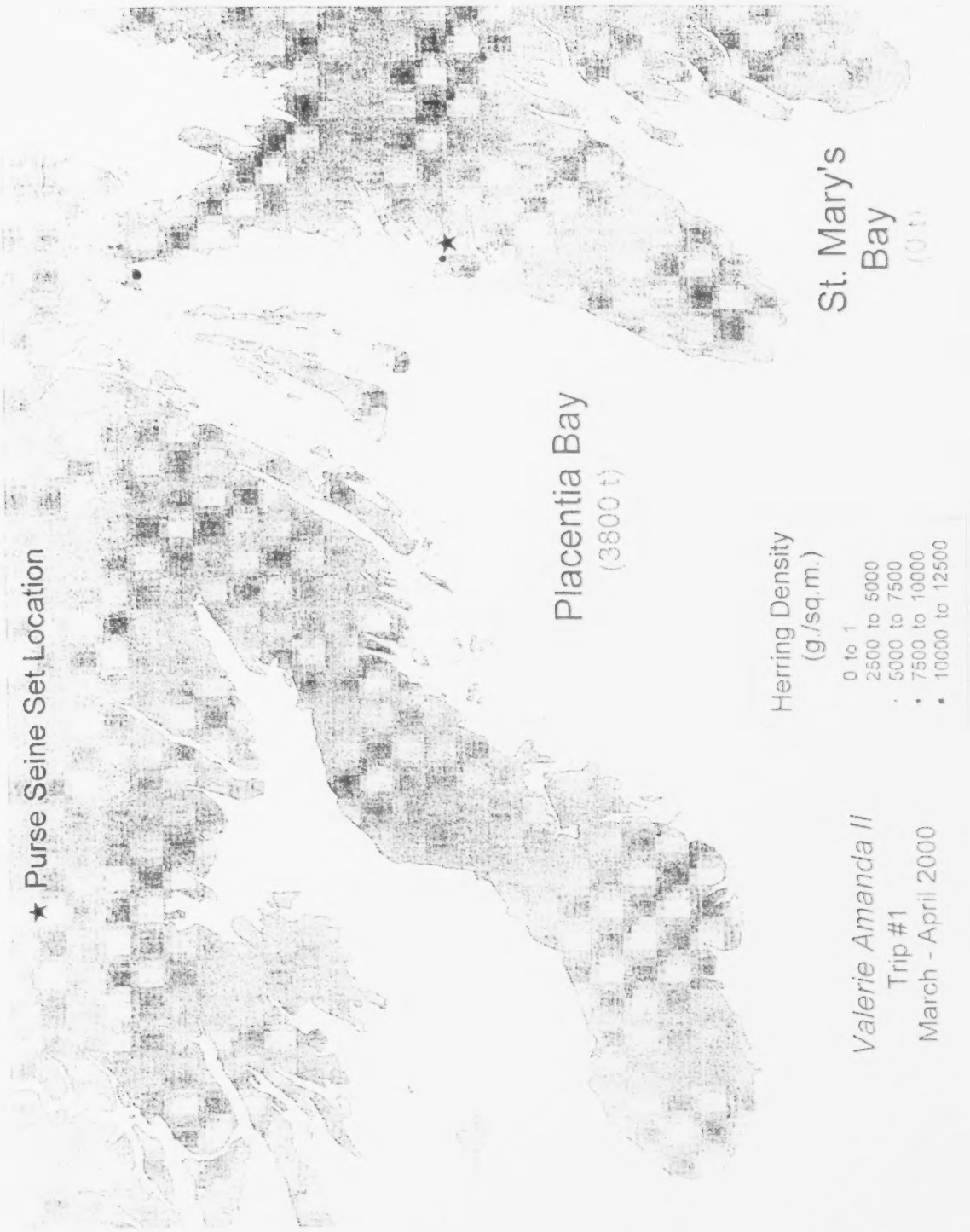


Figure 29. Distribution and density of herring on transects during the 2000 inshore acoustic survey of St. Mary's Bay - Placentia Bay. Relative densities of herring are represented by expanding black symbols.

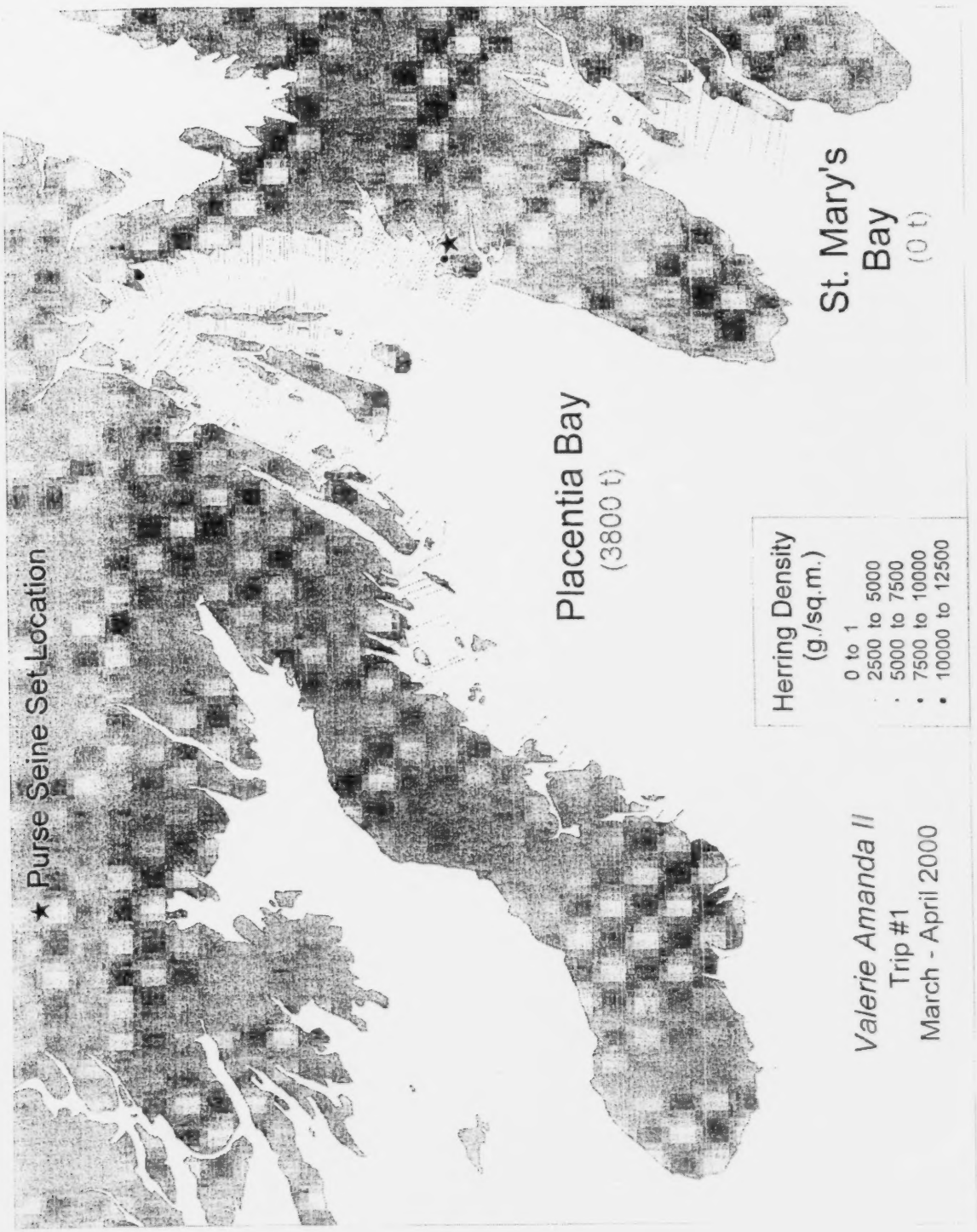
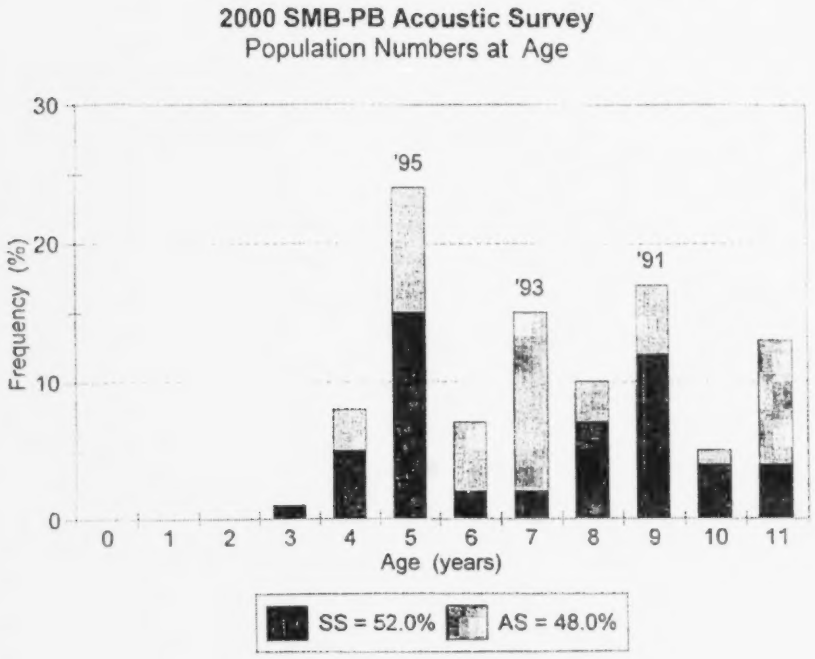


Figure 29. Distribution and density of herring on transects during the 2000 inshore acoustic survey of St. Mary's Bay - Placentia Bay. Relative densities of herring are represented by expanding black symbols.



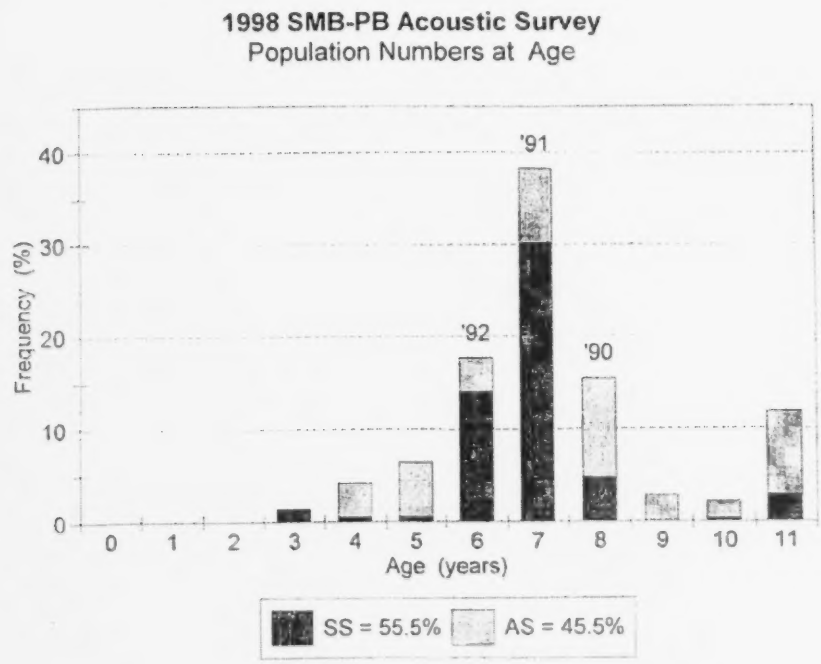


Figure 30. Age distributions of herring from the 2000 and 1998 St. Mary's Bay - Placentia Bay acoustic surveys.

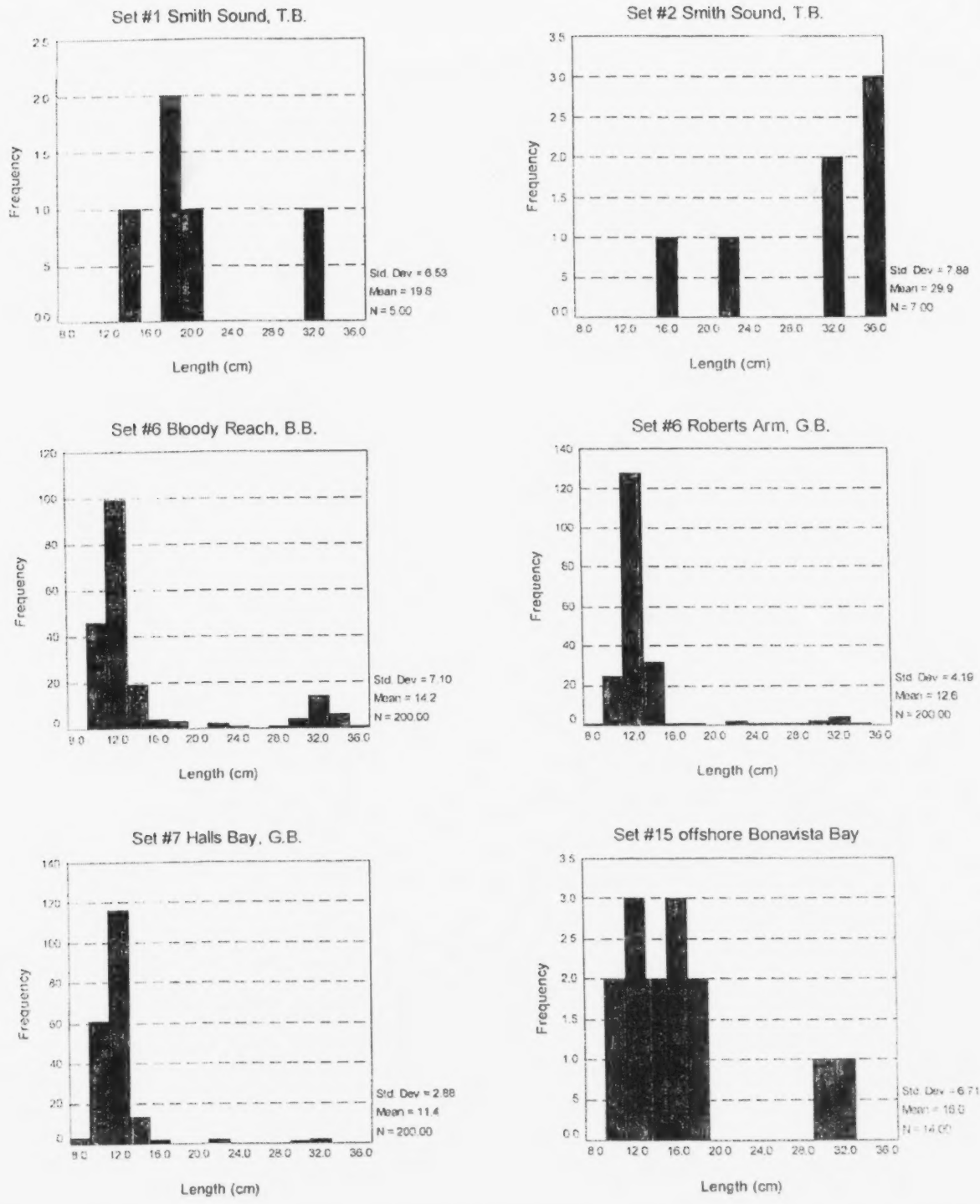


Figure 31. Length distributions of biological samples, by set location, from a 2000 acoustic survey of selected locations along the northeast Newfoundland coast.

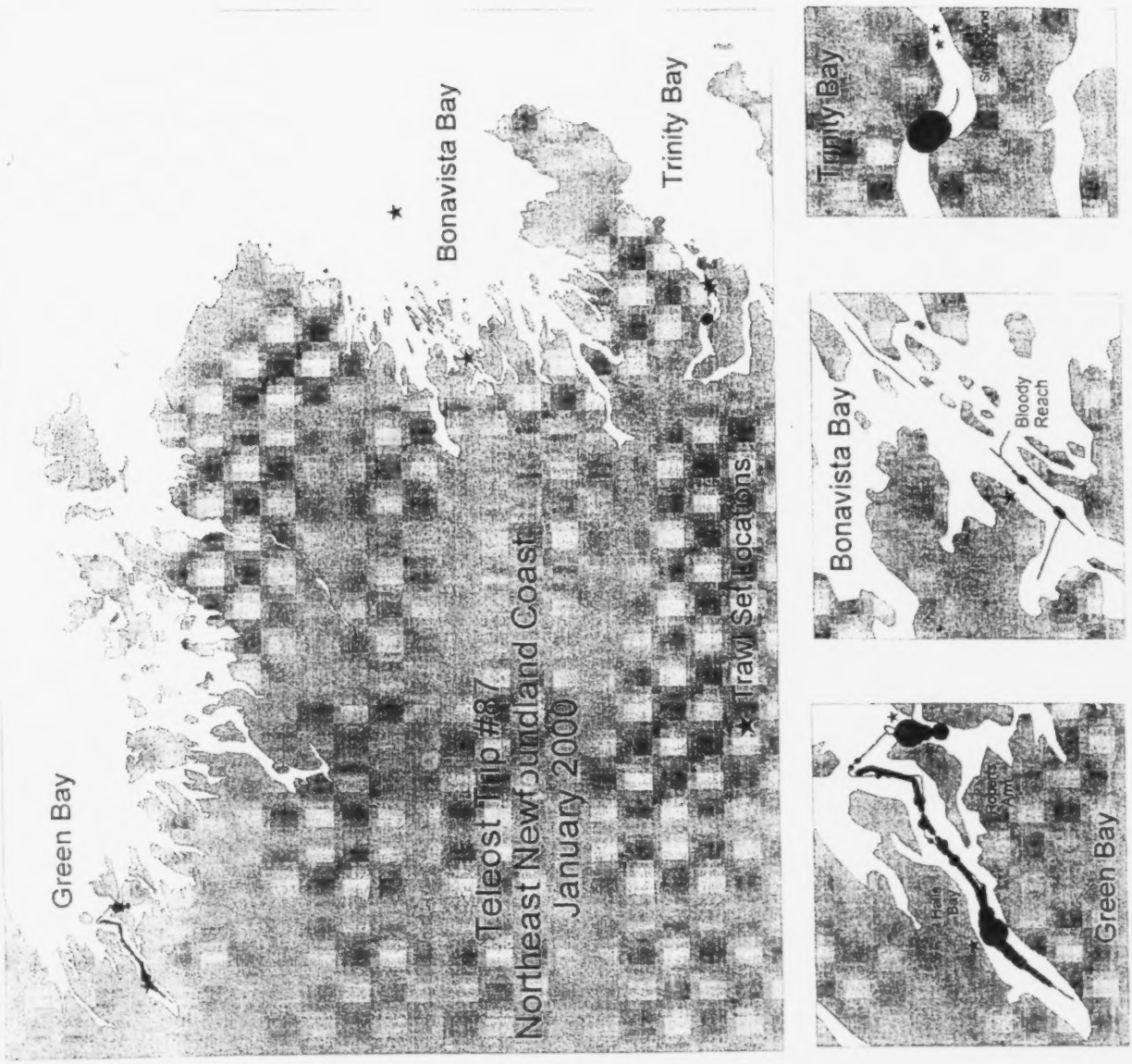


Figure 32. Distribution and relative densities of herring during an acoustic survey of selected locations along the northeast Newfoundland coast, January 2000.

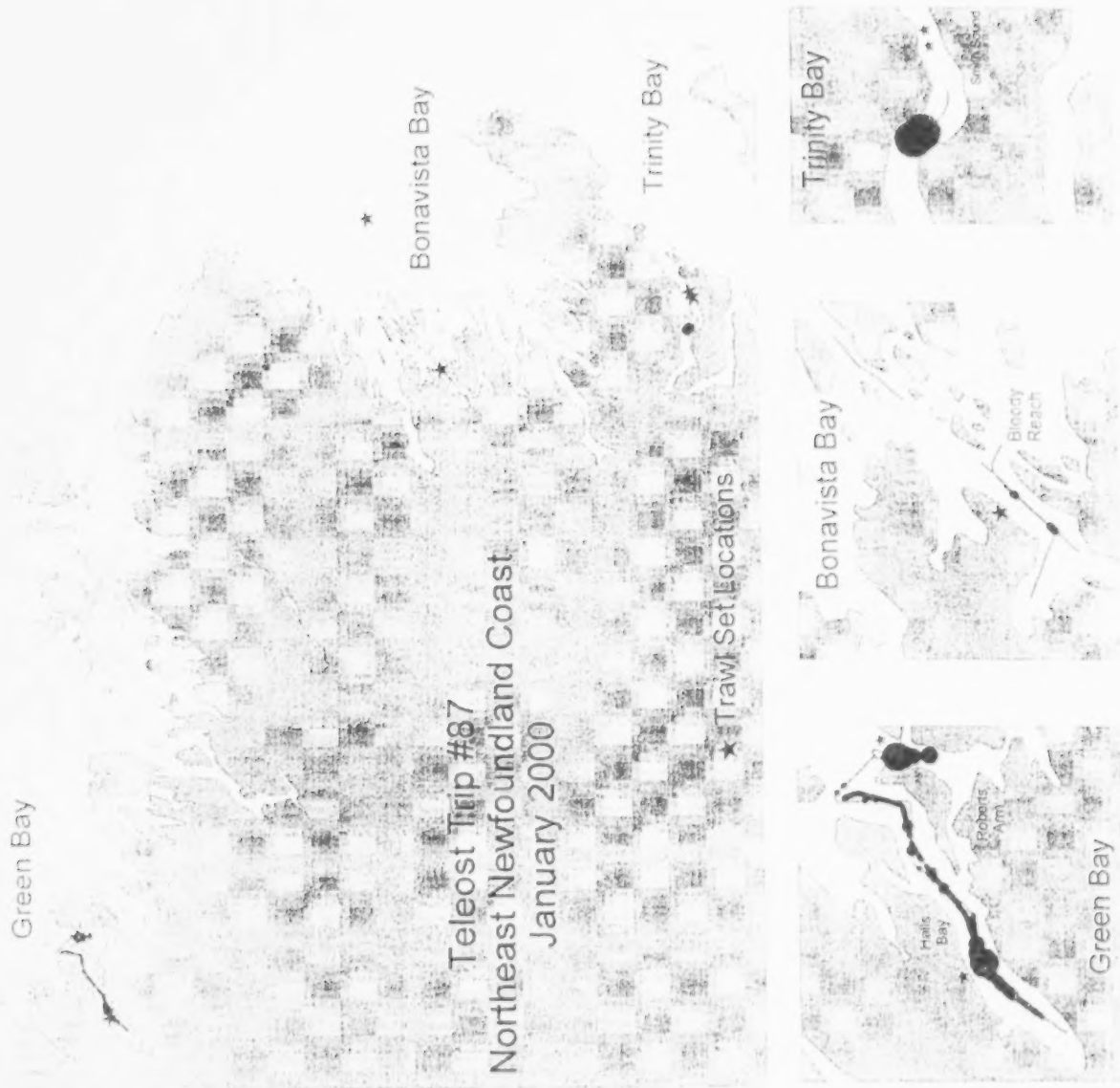


Figure 32. Distribution and relative densities of herring during an acoustic survey of selected locations along the northeast Newfoundland coast, January 2000.

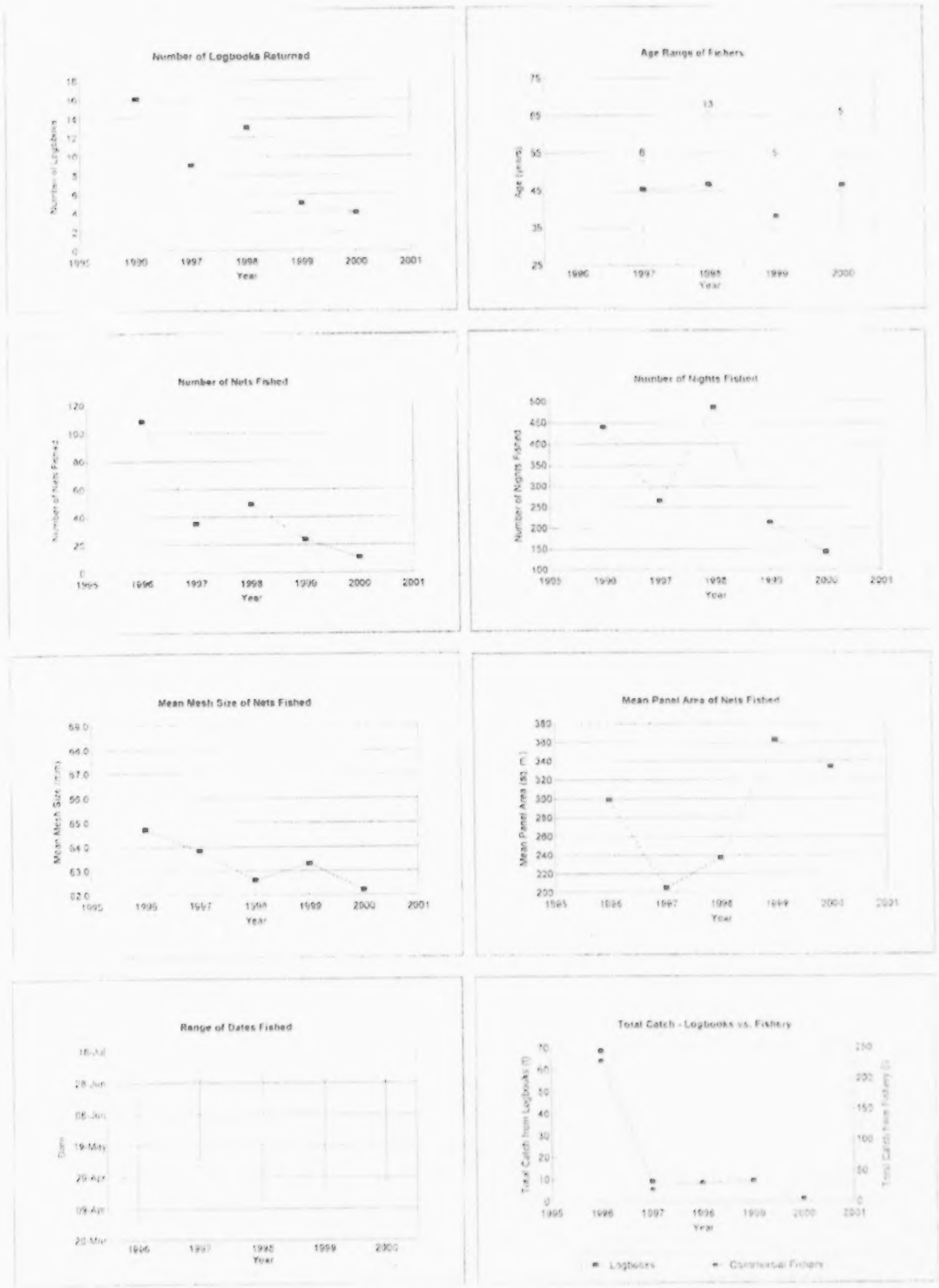


Figure 33. Annual parameters derived from commercial gill net logbooks for White Bay - Notre Dame Bay.

Figure 34. Commercial herring gill net set locations, by year, for White Bay - Notre Dame Bay, from commercial gill net logbooks.

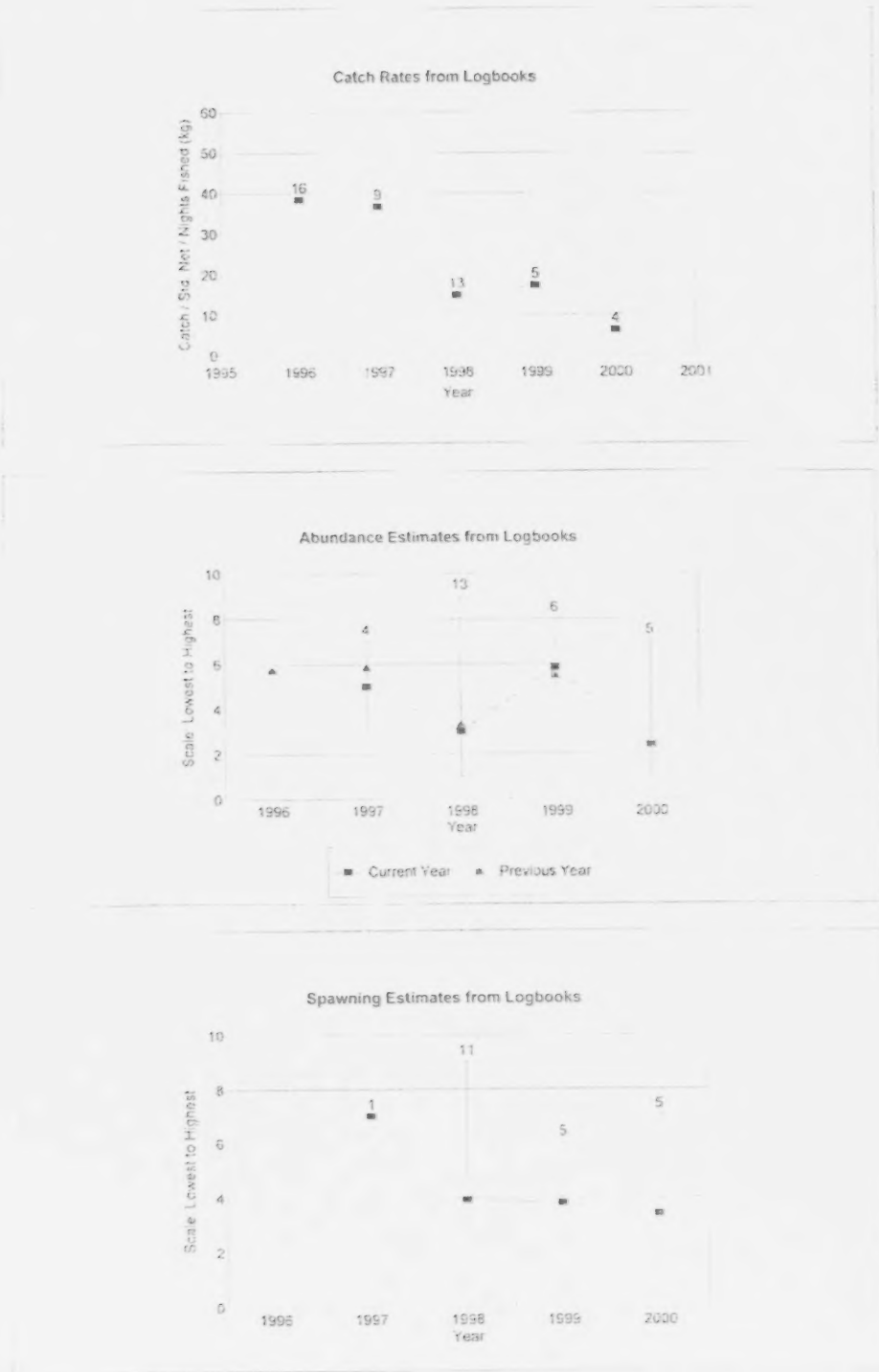


Figure 35. Annual abundance indices derived from commercial gill net logbooks for White Bay - Notre Dame Bay.

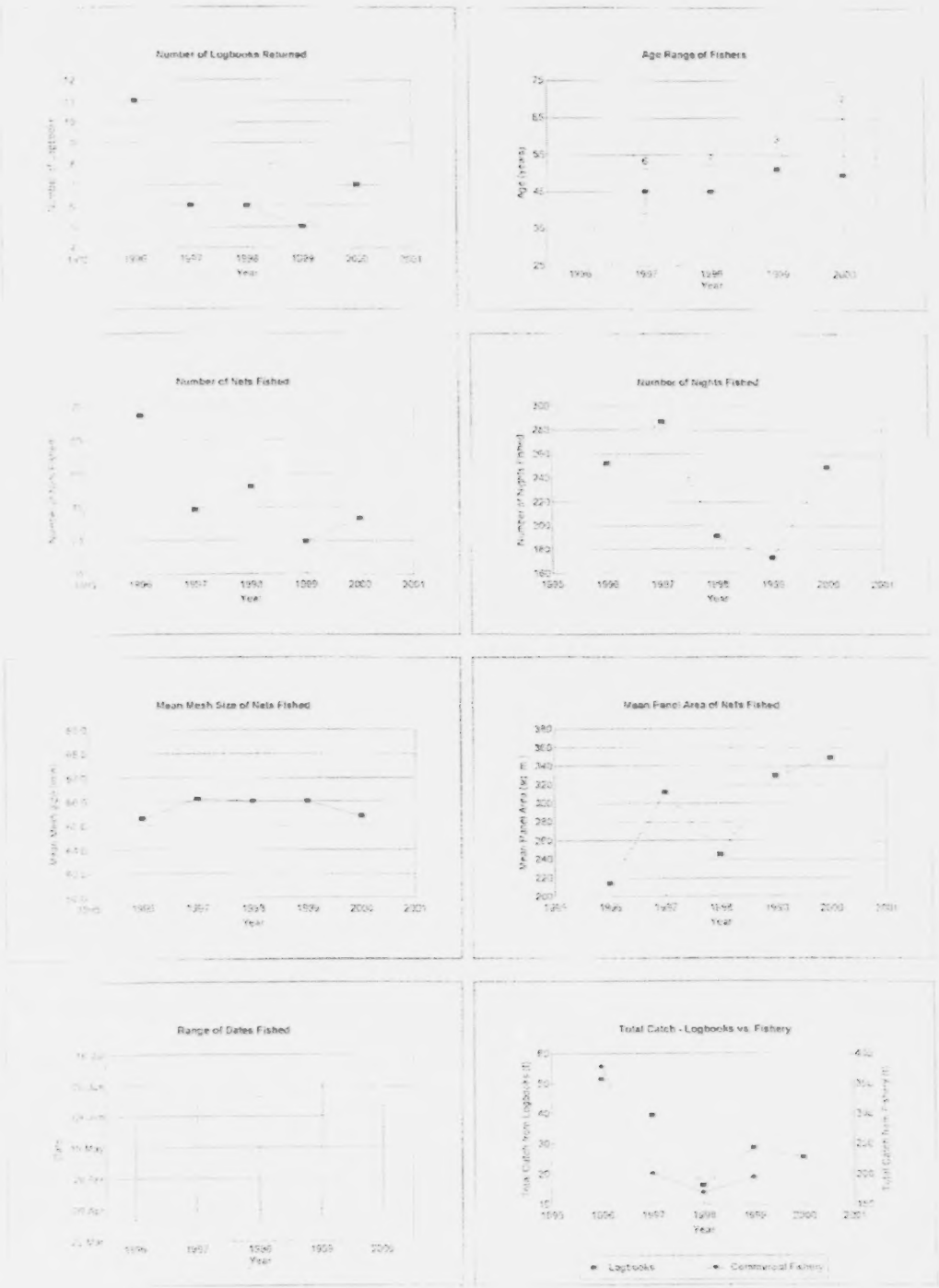


Figure 36. Annual parameters derived from commercial gill net logbooks for Bonavista Bay -Trinity Bay.

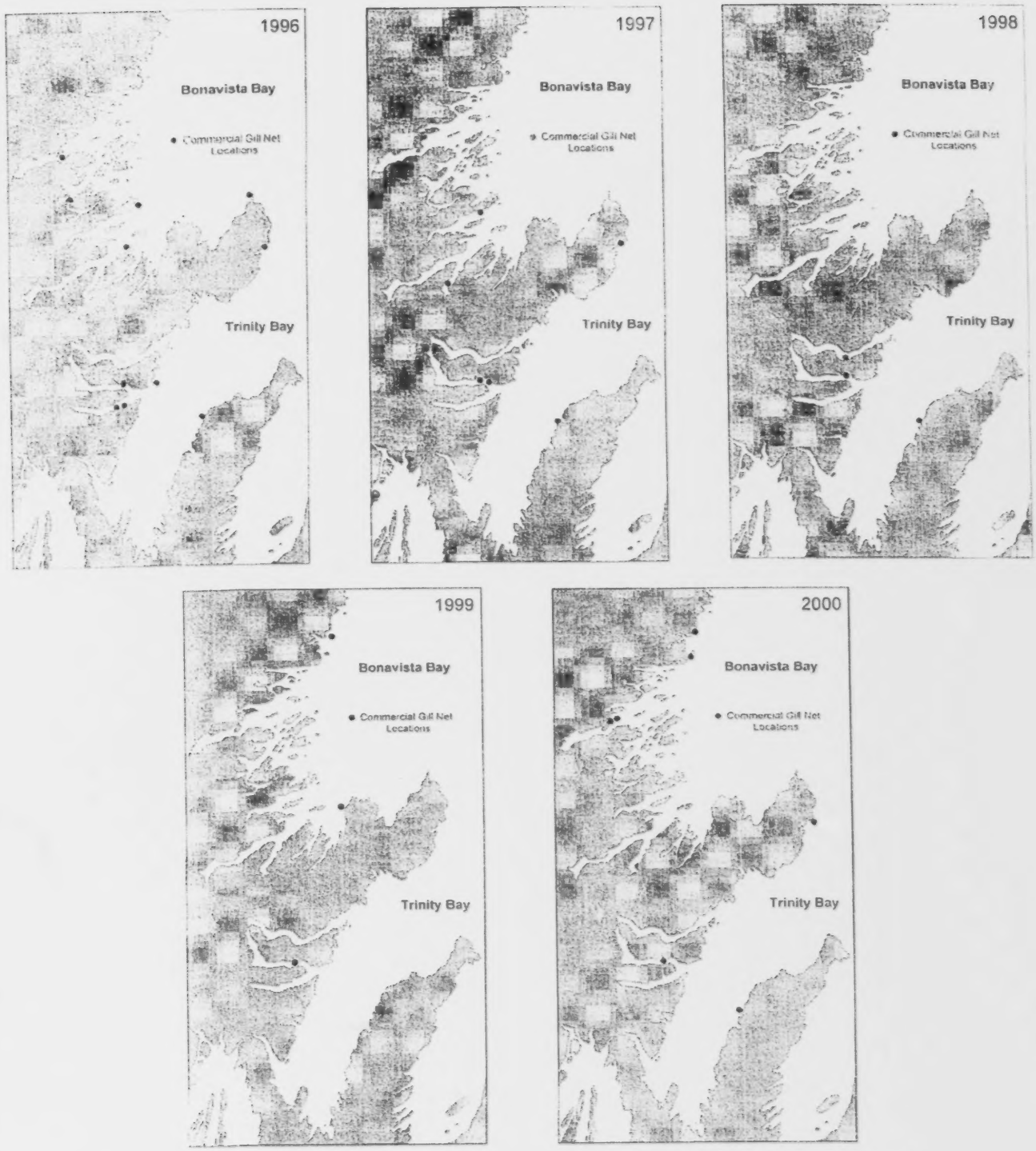
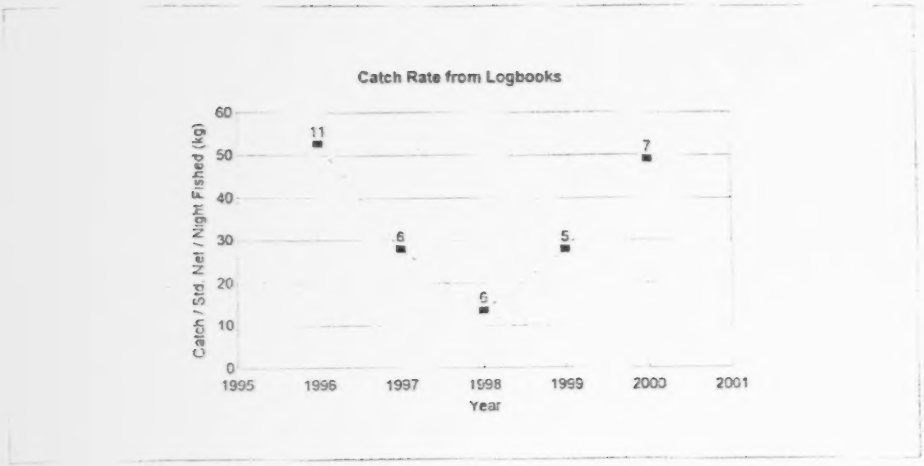
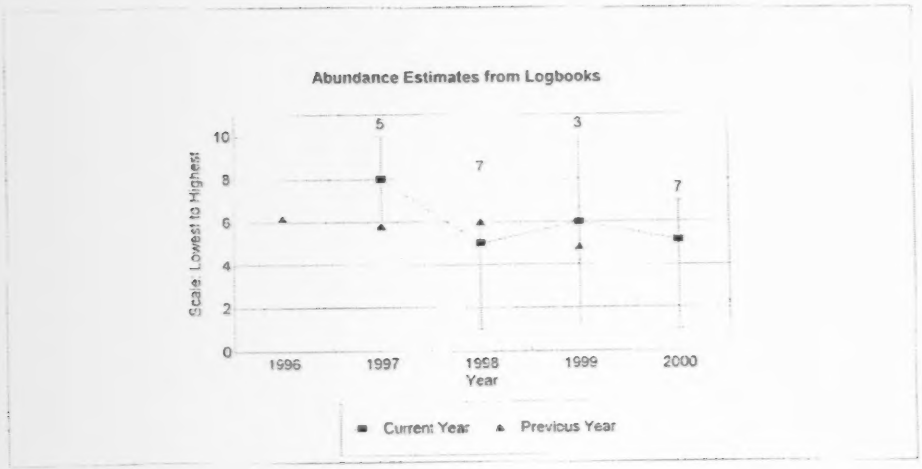


Figure 37. Commercial herring gill net set locations, by year, for Bonavista Bay - Trinity Bay, from commercial gill net logbooks.





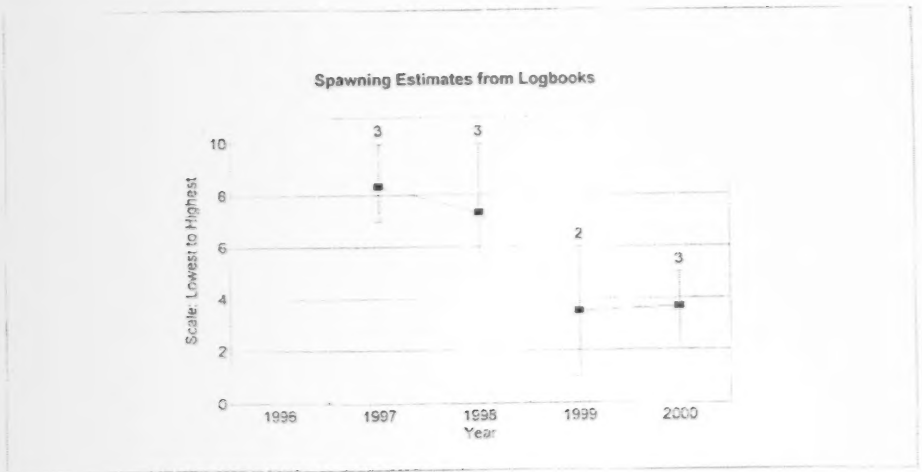


Figure 38. Annual abundance indices derived from commercial gill net logbooks for Bonavista Bay - Trinity Bay.

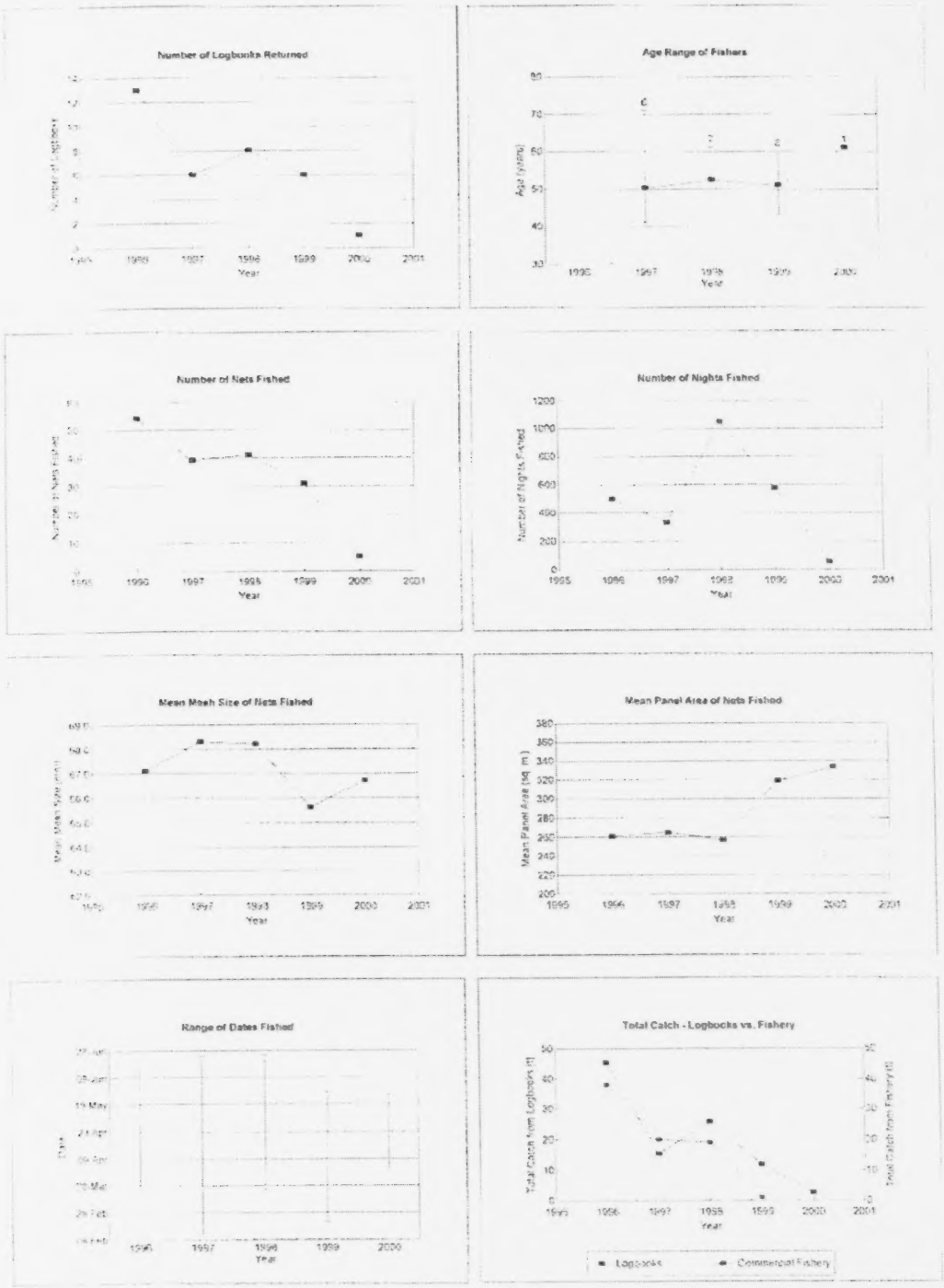


Figure 39. Annual parameters derived from commercial gill net logbooks for St. Mary's Bay - Placentia Bay.

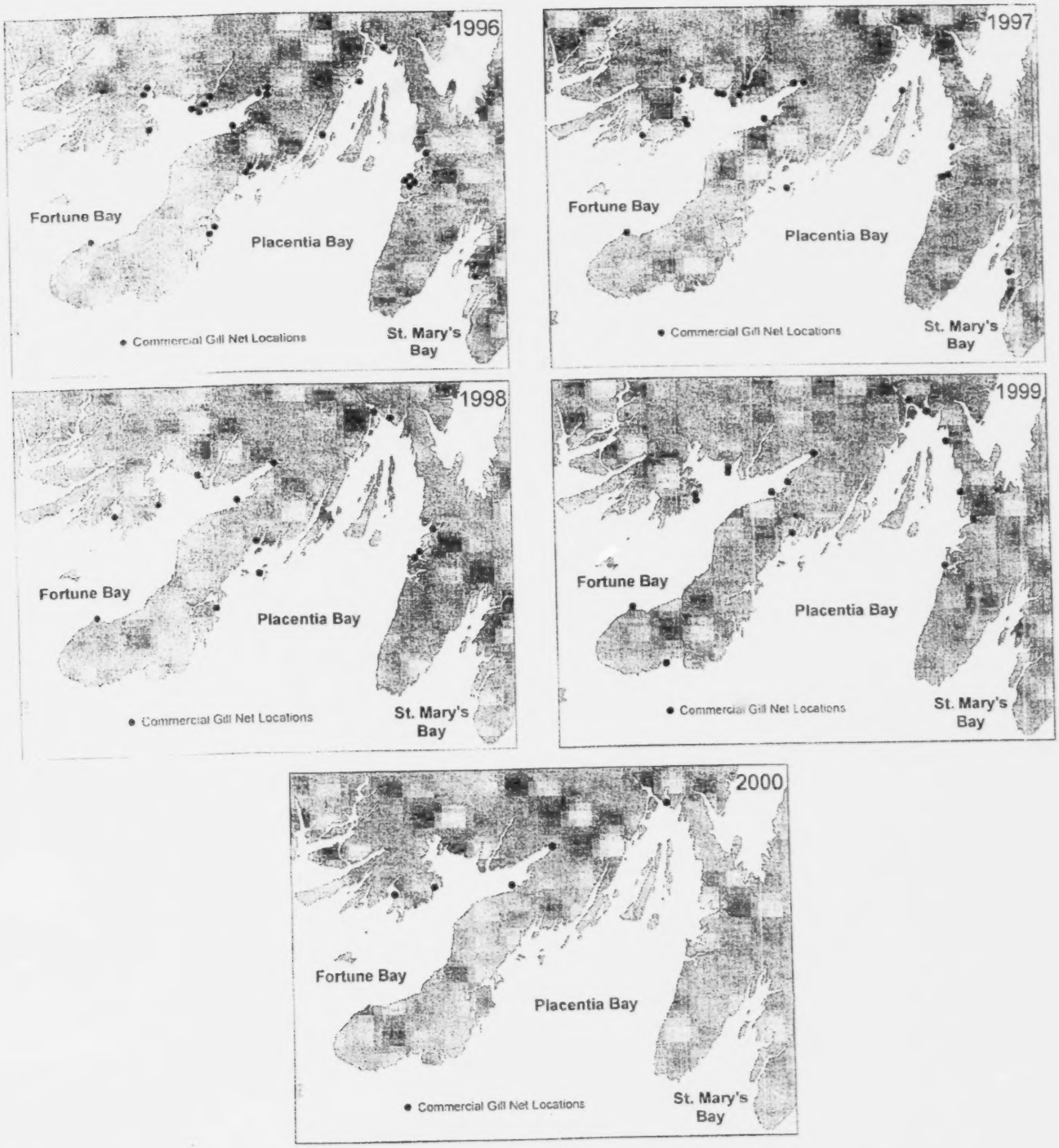
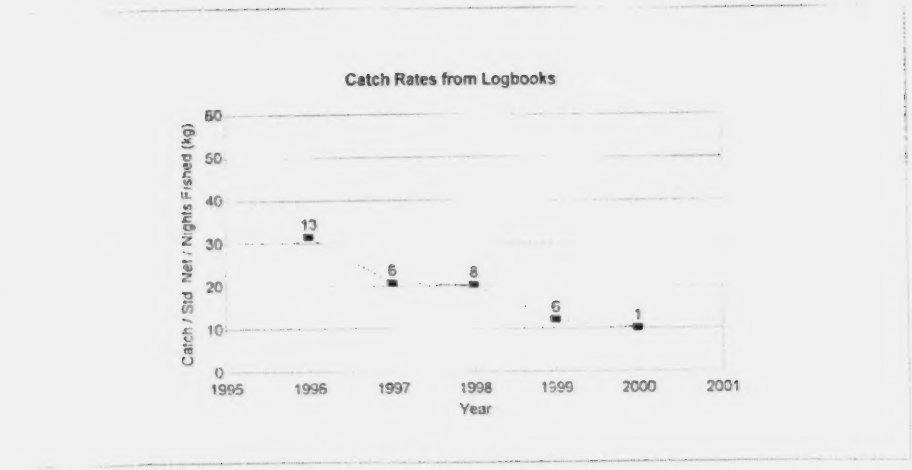
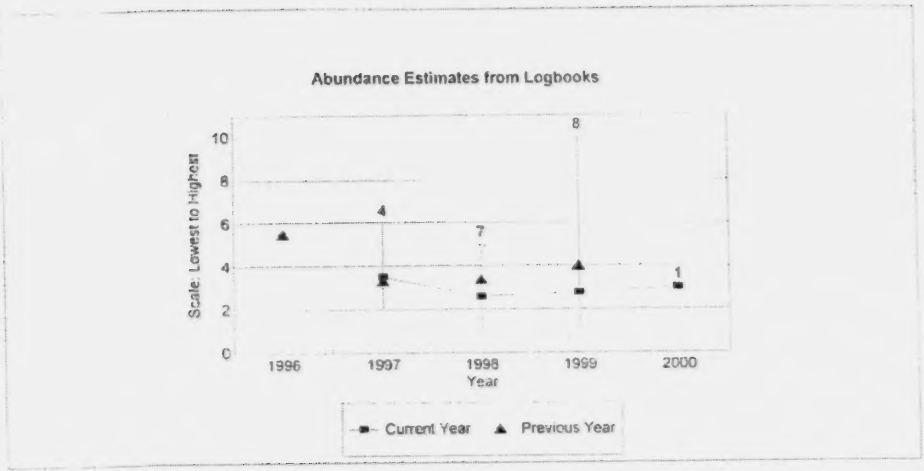


Figure 40. Commercial herring gill net set locations, by year, for St. Mary's Bay - Placentia Bay and Fortune Bay from commercial gill net logbooks.





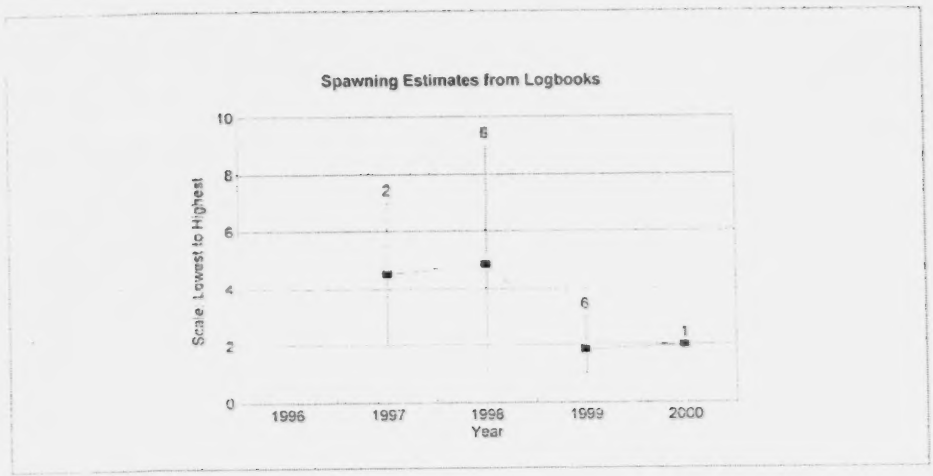


Figure 41. Annual abundance indices derived from commercial gill net logbooks for St. Mary's Bay - Placentia Bay.

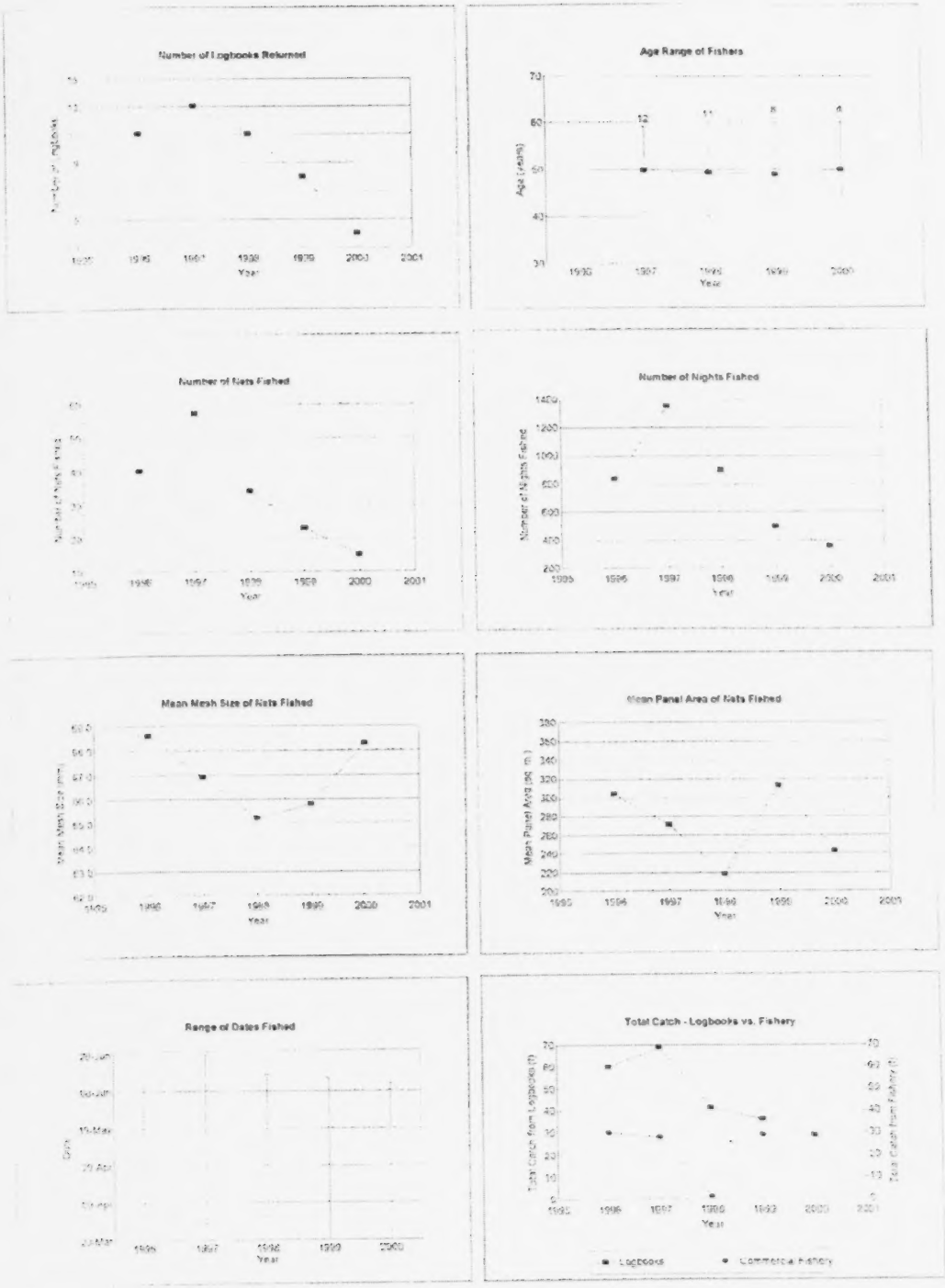


Figure 42. Annual parameters derived from commercial gill net logbooks for Fortune Bay.

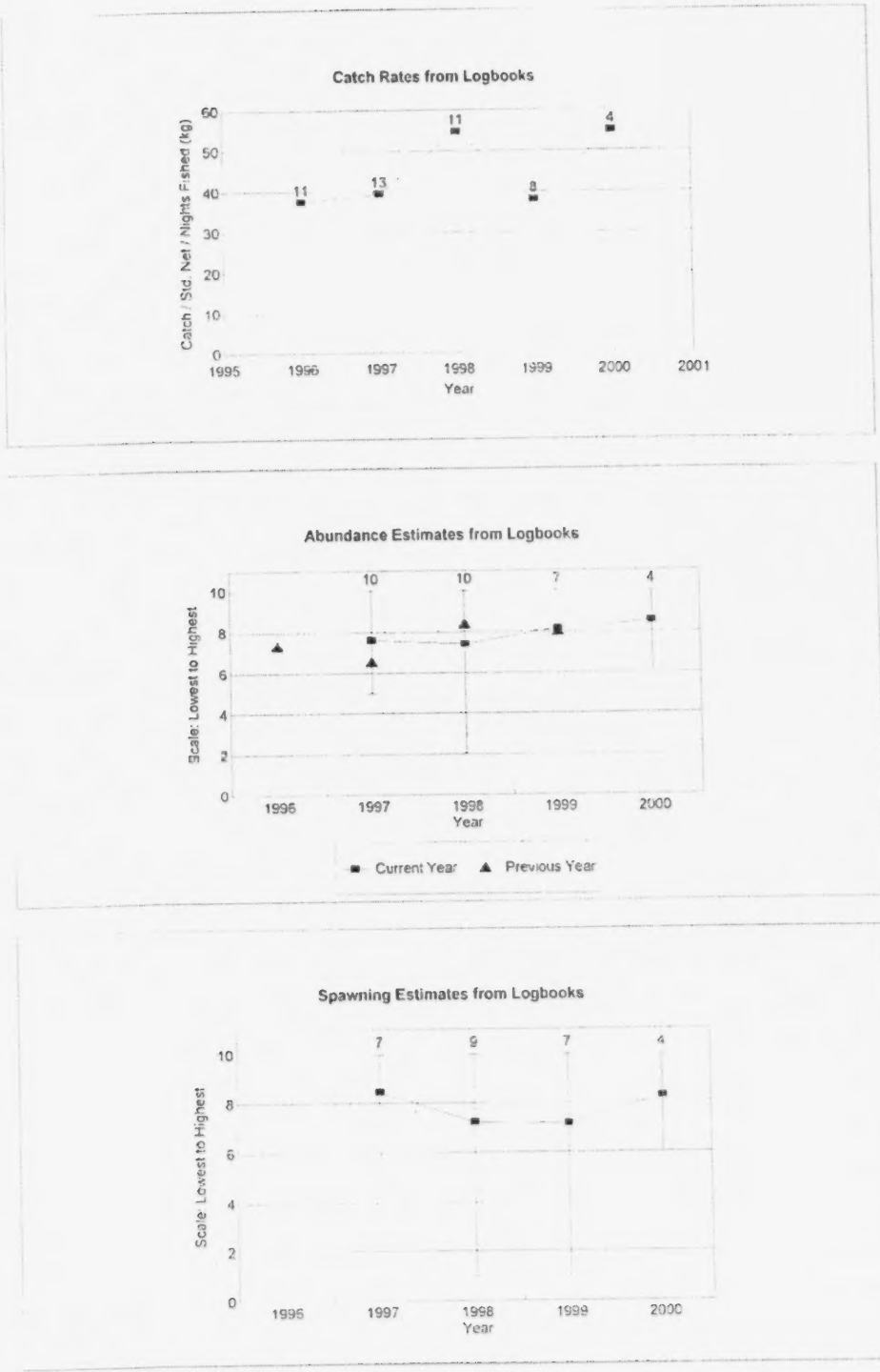


Figure 43. Annual abundance indices derived from commercial gill net logbooks for Fortune Bay.

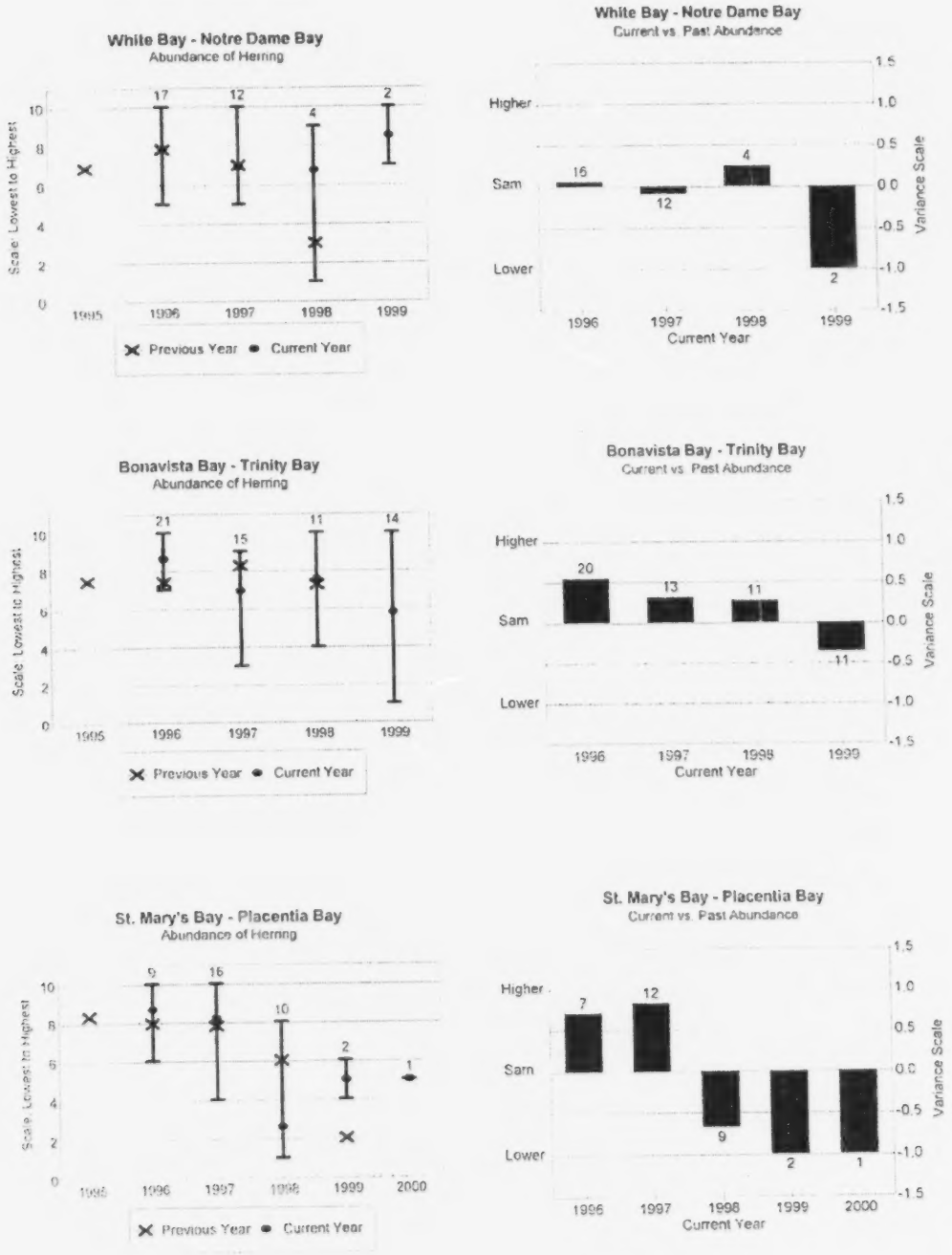
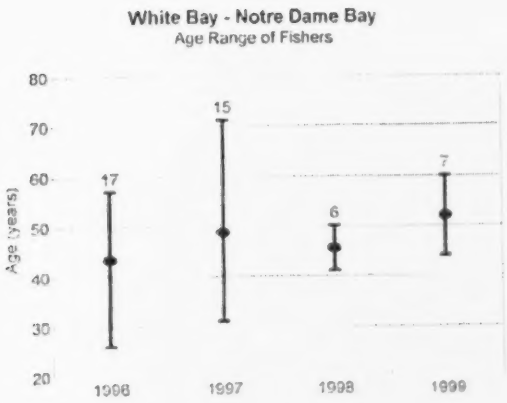
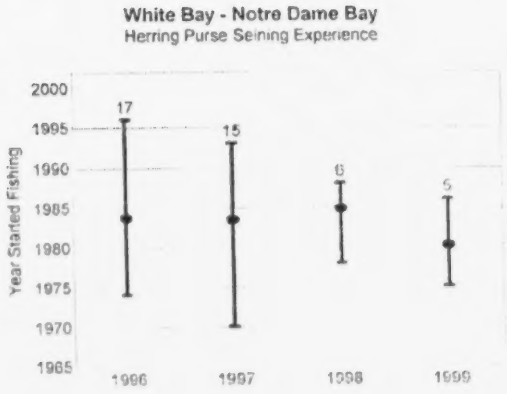
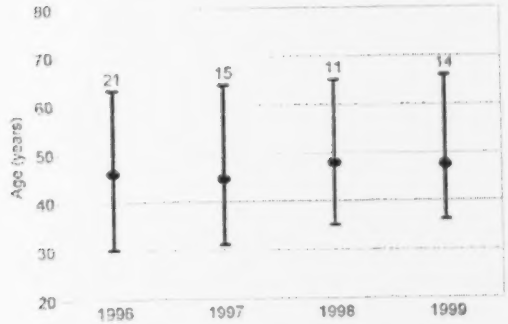
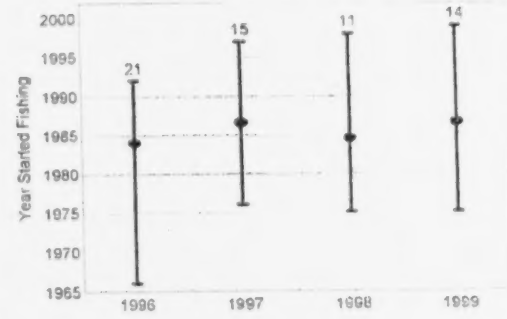


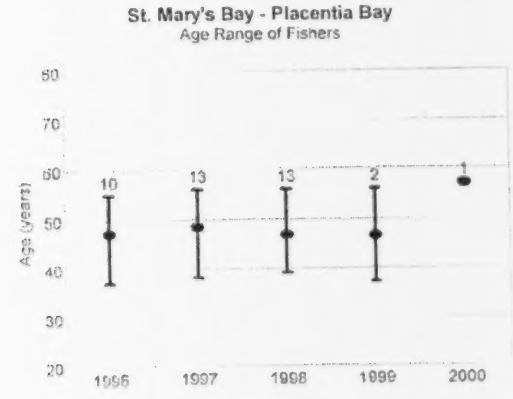
Figure 44. Responses to questions regarding abundance (numbers) of herring in home bay in current and previous year (left panels) compared to when you first started fishing herring (right panels). Solid circles represent means for the current year; x's represent means for the previous year as estimated during the current year. Vertical lines represent range of responses; samples sizes are listed above each vertical line and bar.











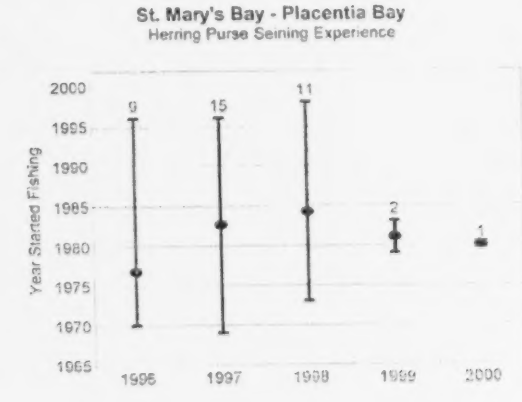


Figure 45. Age range and fishing experience of purse seine fishers. Solid circles represent means for the current year, vertical lines represent the range of responses, and sample sizes are listed above each line.

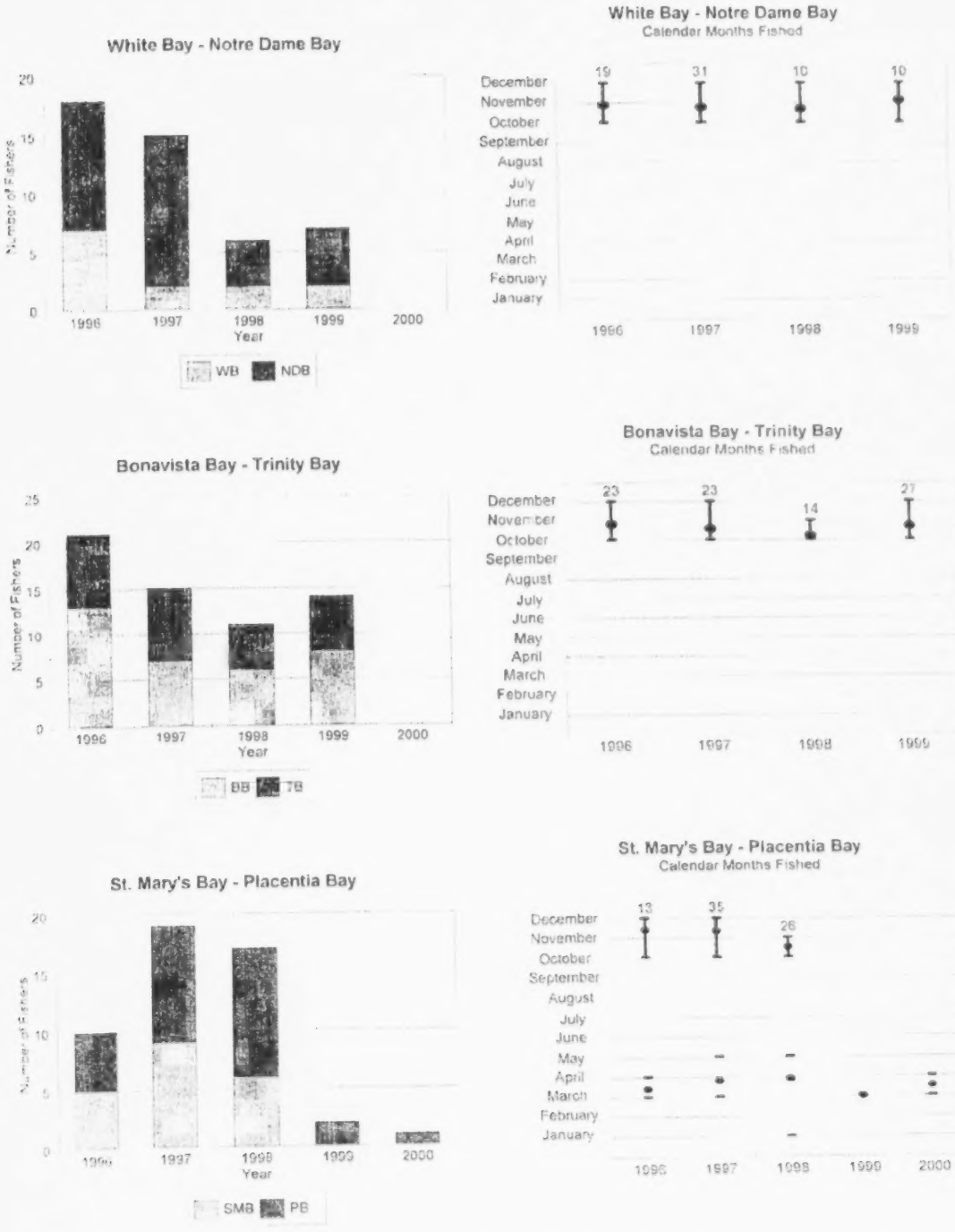


Figure 46. Responses to questions regarding bays fished (left panels) and months fished (right panels). Solid circles (right panels) represent means, horizontal bars represent the range of responses, and sample sizes are listed at the top.

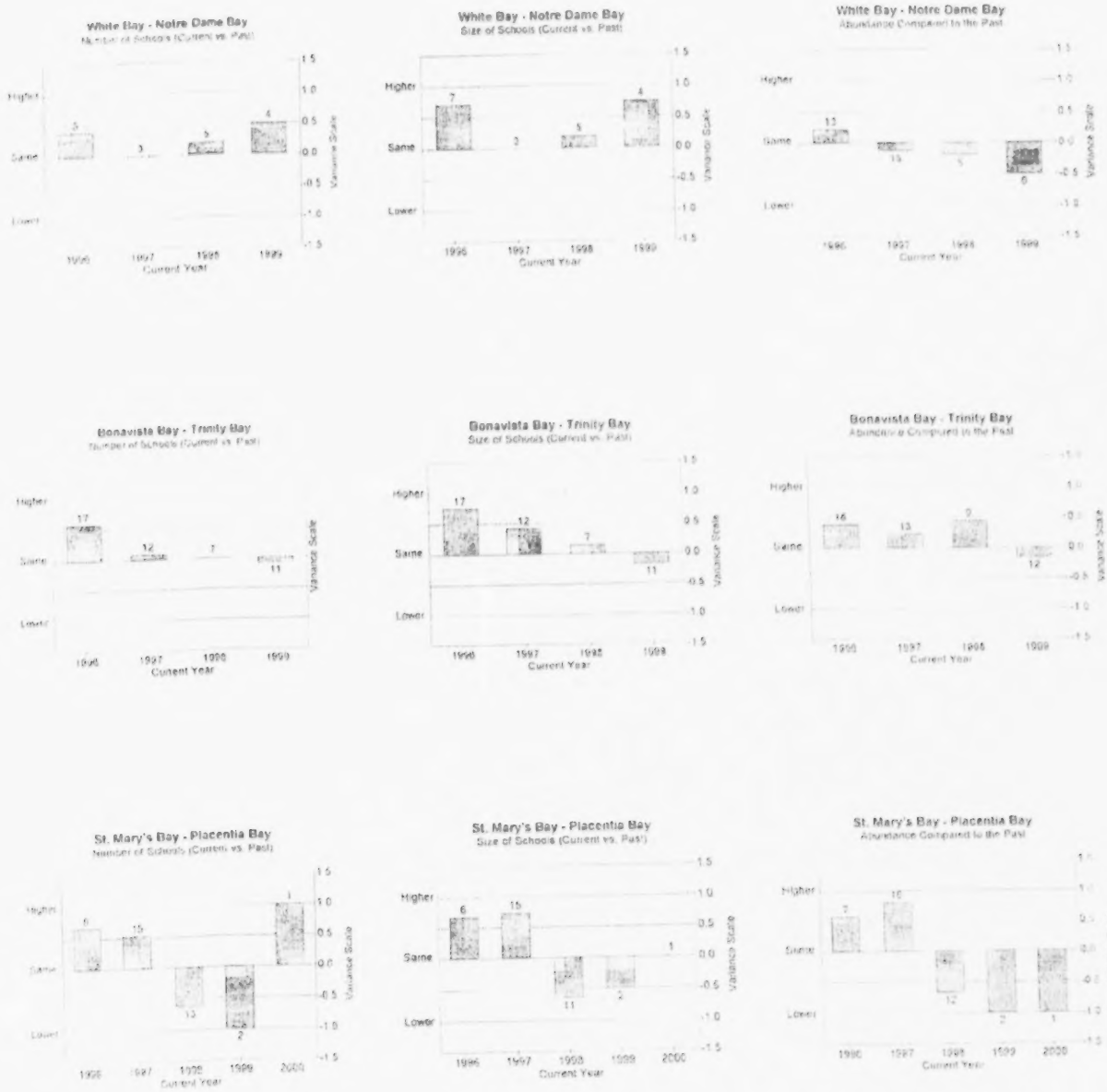

White Bay - Notre Dame Bay
Size of Schools (Current vs. Past)
Higher
Same
Lower
Current Year
Variance Scale
White Bay - Notre Dame Bay
Abundance Compared to the Past
Bonavista Bay - Trinity Bay
Size of Schools (Current vs. Past)
Bonavista Bay - Trinity Bay
Abundance Compared to the Past
St. Mary's Bay - Placentia Bay
Size of Schools (Current vs. Past)
St. Mary's Bay - Placentia Bay
Abundance Compared to the Past

Figure 47. Responses to questions regarding the number (left panels) and size (middle panels) of herring schools detected (per day) during the fishery in the current year compared to the previous year, and abundance during current fishery compared to when you firs started fishing herring (right panels). Sample sizes are listed above each bar.

Figure 48. Responses to question regarding locations of successful sets (sets in which herring were caught) in White Bay - Notre Dame Bay (WB-NDB).

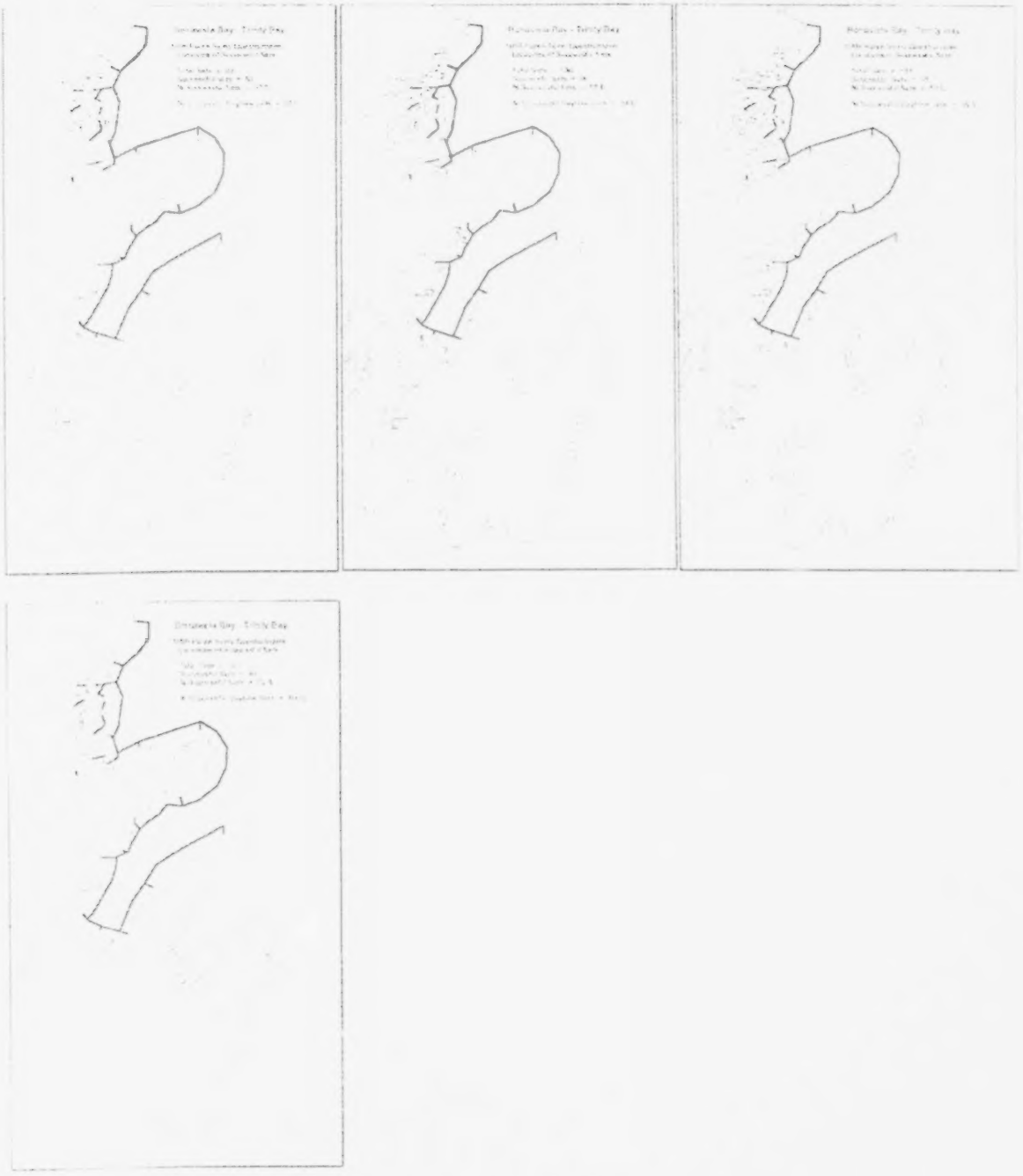


Figure 48 (cont.'). Responses to question regarding locations of successful sets (sets in which herring were caught) in Bonavista Bay - Trinity Bay (BB-TB).

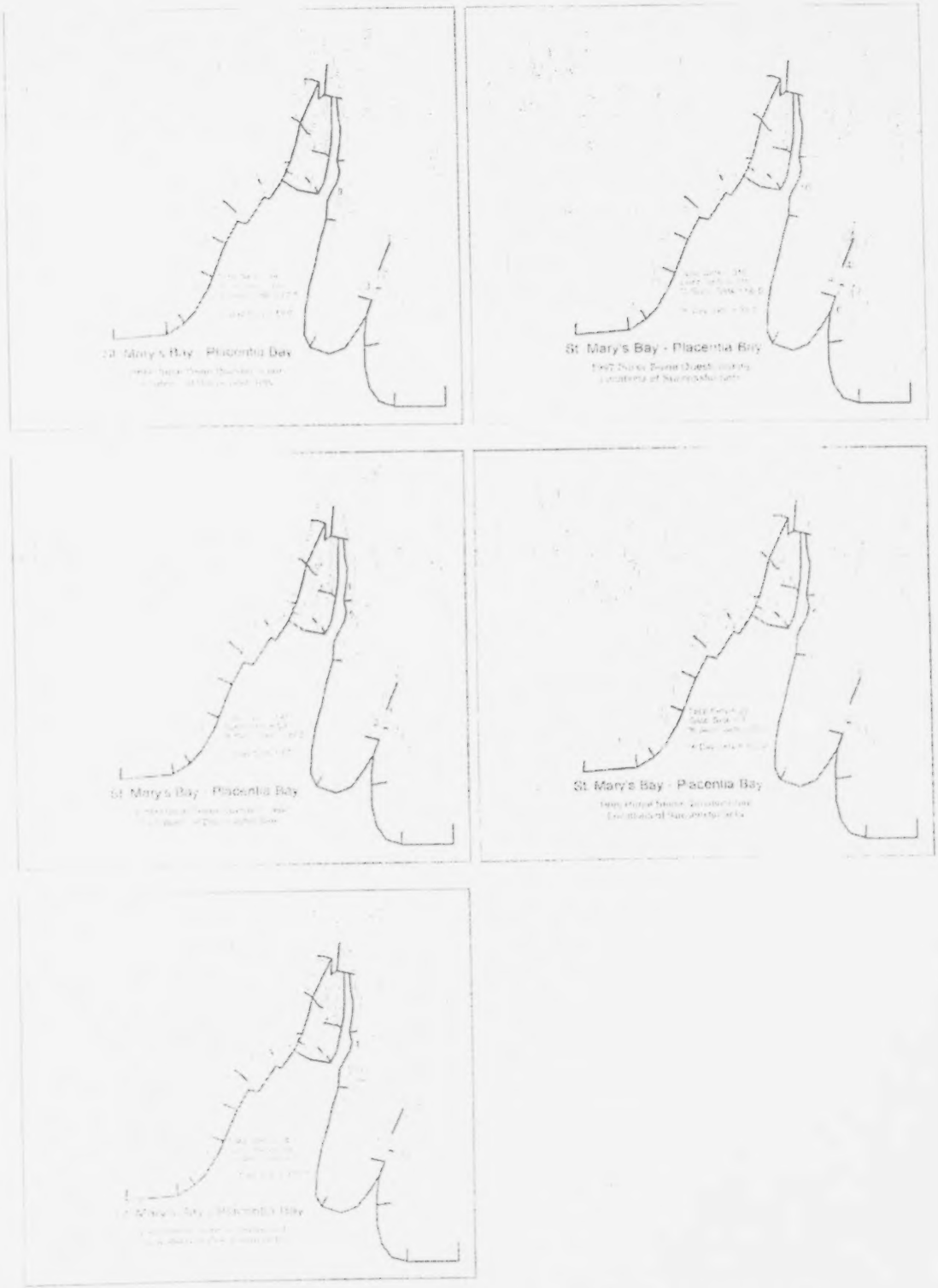
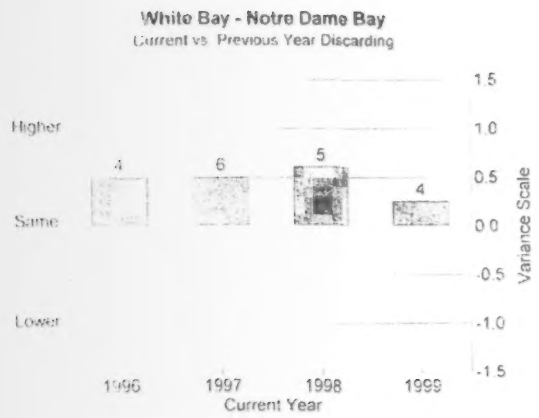
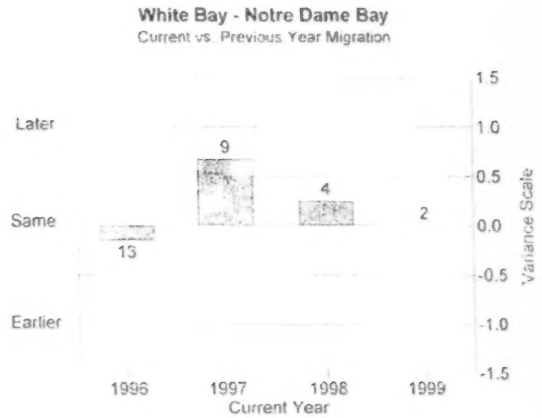
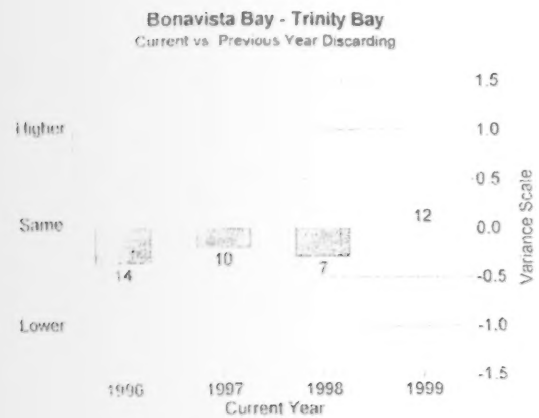


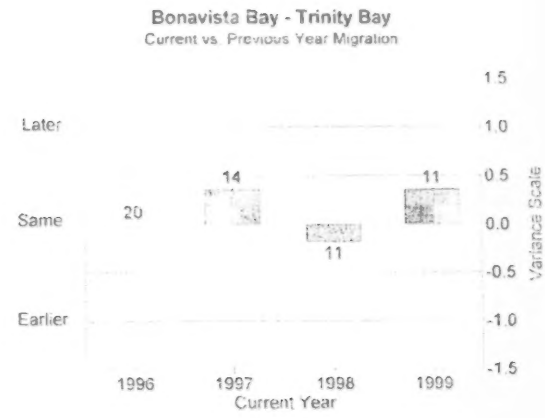
Figure 48 (cont.). Responses to question regarding locations of successful sets (sets in which herring were caught) in St. Mary's Bay - Placentia Bay (SMB-PB).

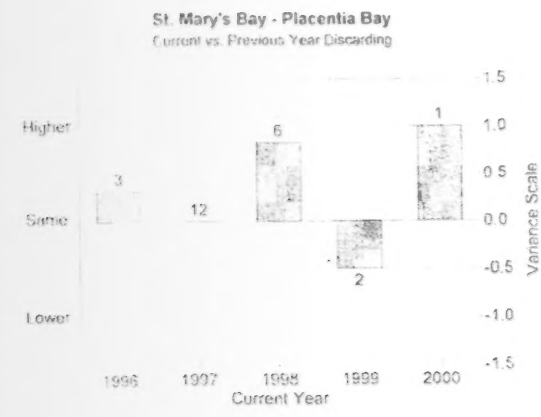
Figure 49. Responses to question regarding why herring were discarded during the fishery; sample sizes are listed by each bar.











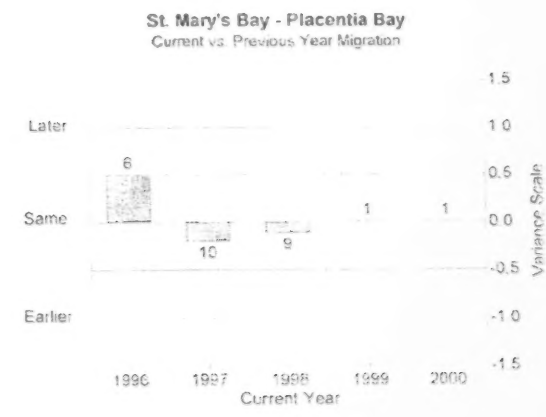


Figure 50. Responses to questions regarding the amount of herring discarded during the fishery in the current year compared to the previous year (left panels), and responses regarding the seasonal timing of herring migration in the current year compared to the previous year (right panels). Sample sizes are listed above each bar.

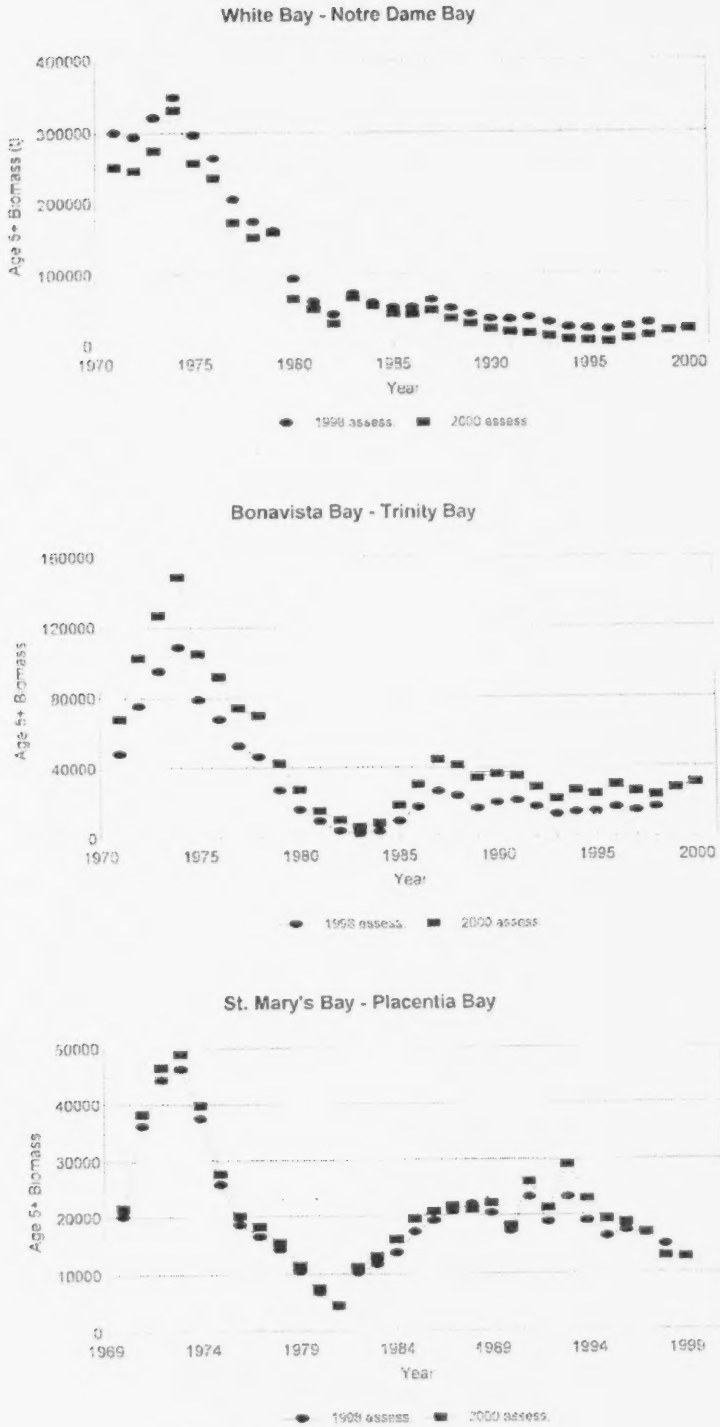
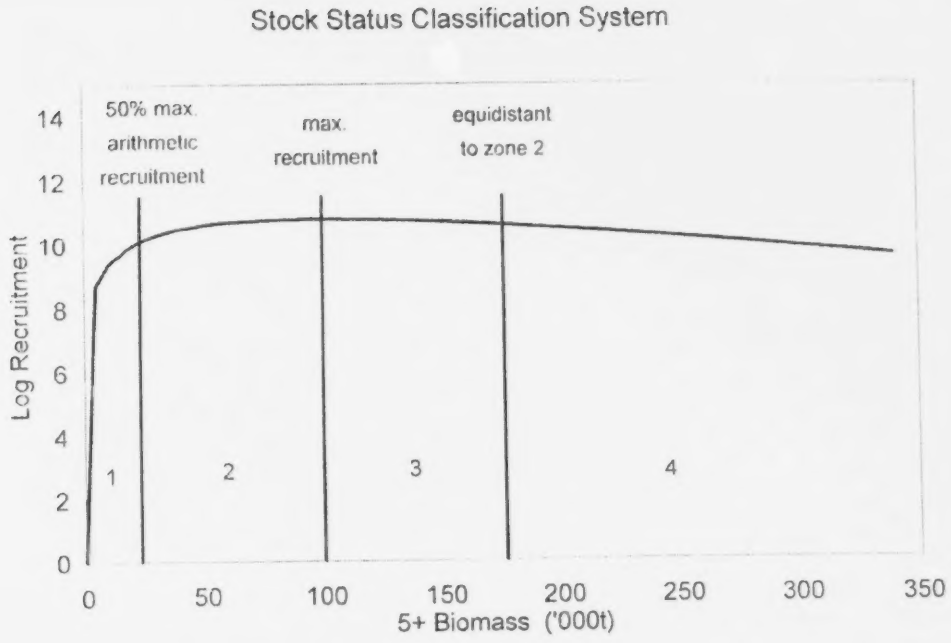
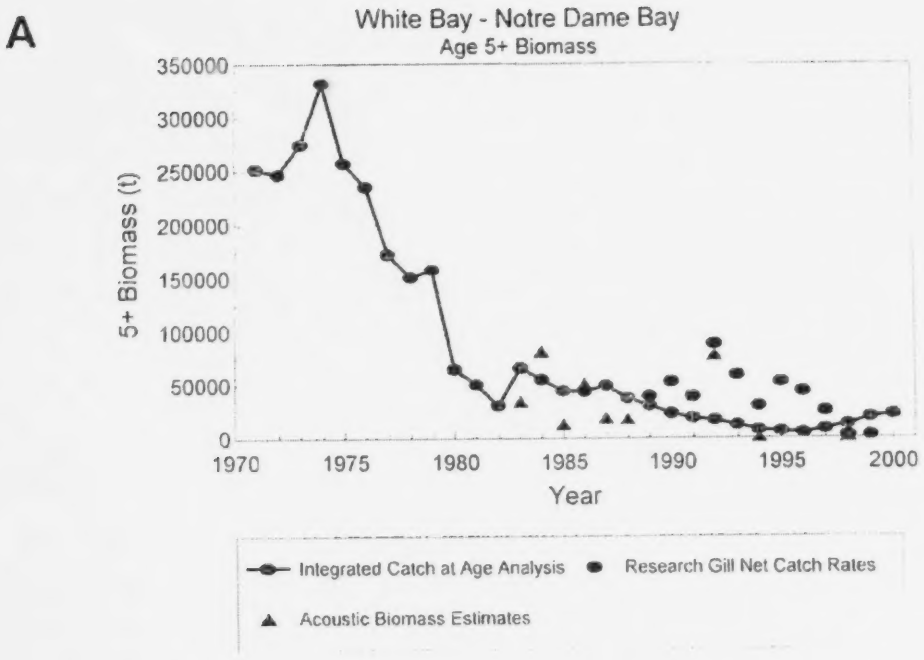


Figure 51. Comparison of age 5+ integrated catch at age biomass estimates for WB-NDB, BB-TB, and SMB-PB from this assessment and 1998 assessment



Zone	Stock Status	F	Type of Fishery
1	Very Poor	0.00 - 0.05	Scientific
2	Poor to Moderate	0.05 - 0.10	Restricted
3	Moderate to Good	0.10 - 0.20	Commercial
4	Good to Very Good	>=0.20	Accelerated

Figure 52. Definition of zones, descriptors, and exploitation rates for east and southeast Newfoundland herring stock status classification system.



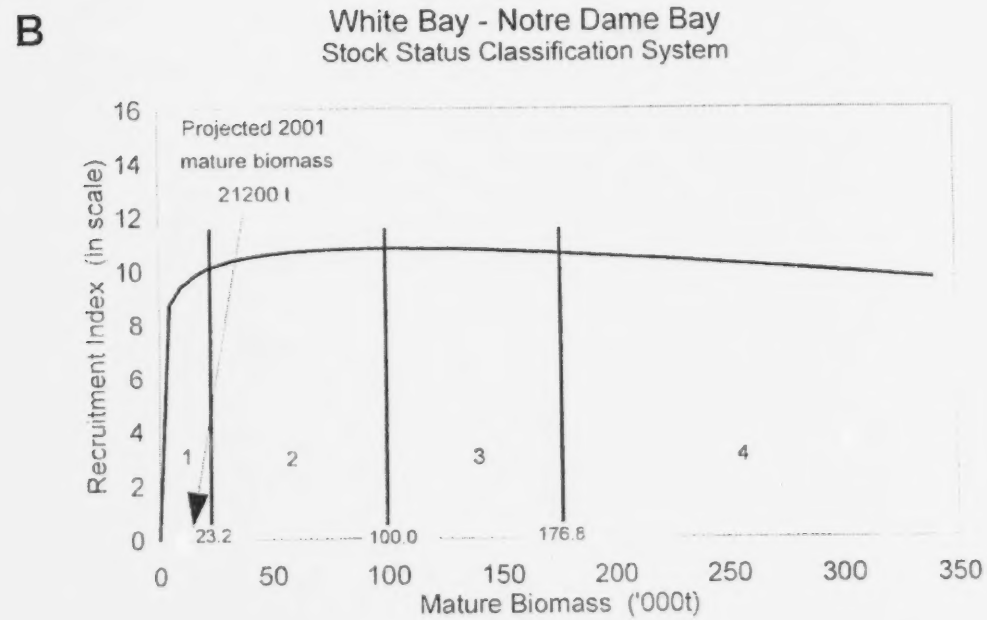
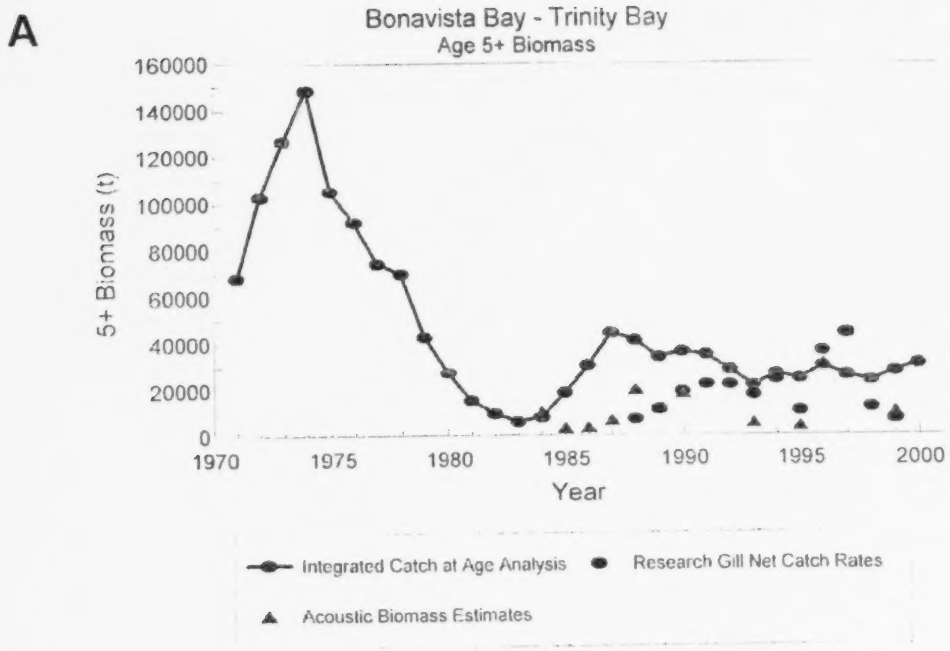


Figure 53. Panel A: Comparison of age 5+ biomass estimates from ICA with abundance indices. Panel 2: Stock status classification zones and projected 2001 mature biomass estimate.



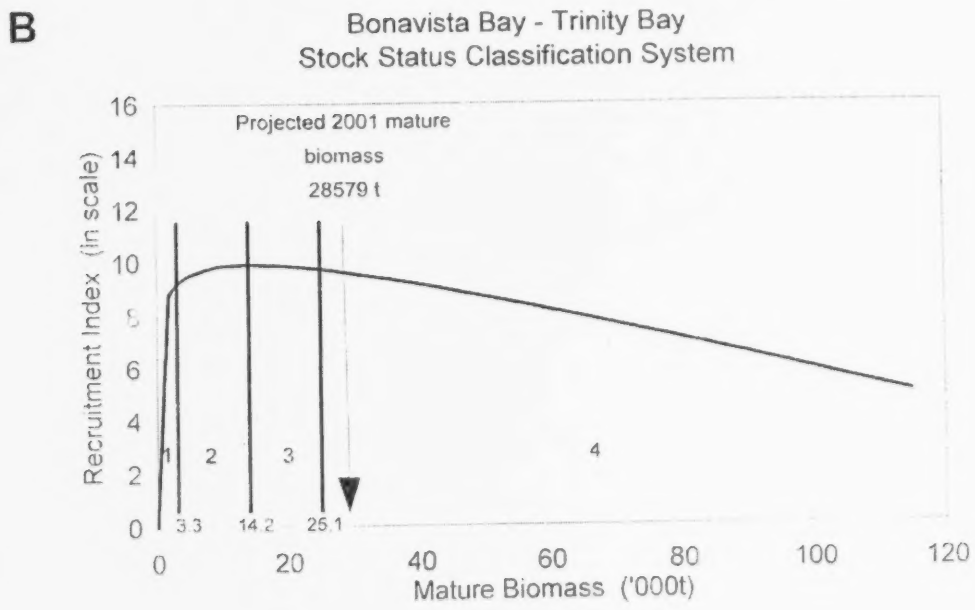
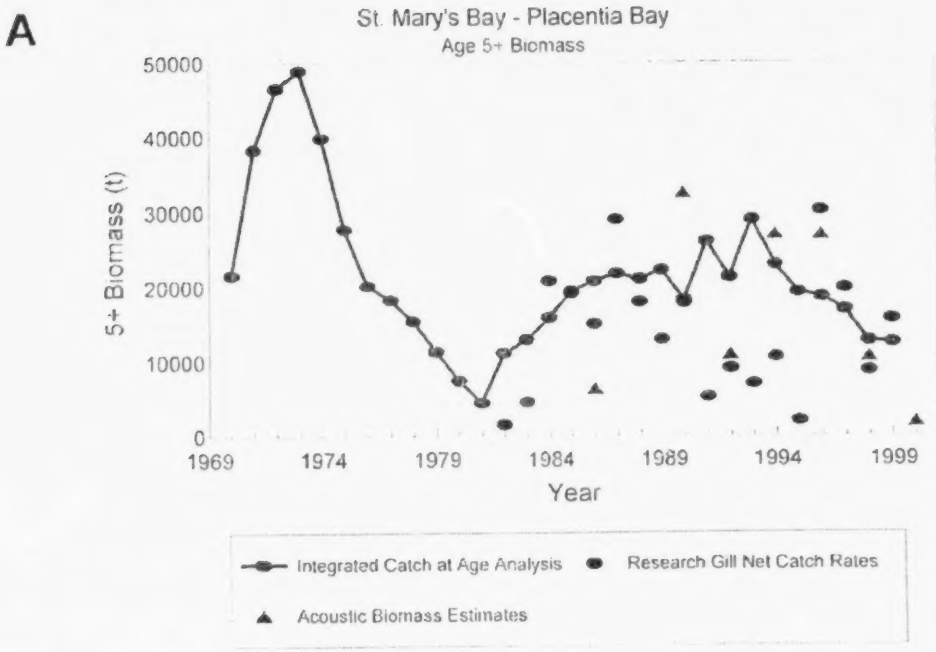


Figure 54. Panel A: Comparison of age 5+ biomass estimates from ICA with abundance indices. Panel 2: Stock status classification zones and projected 2001 mature biomass estimate.



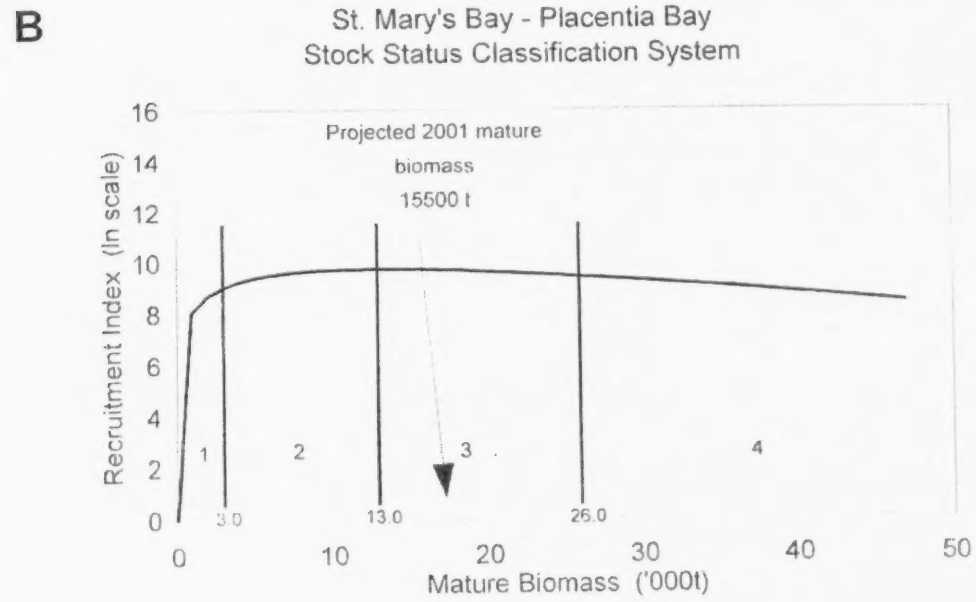
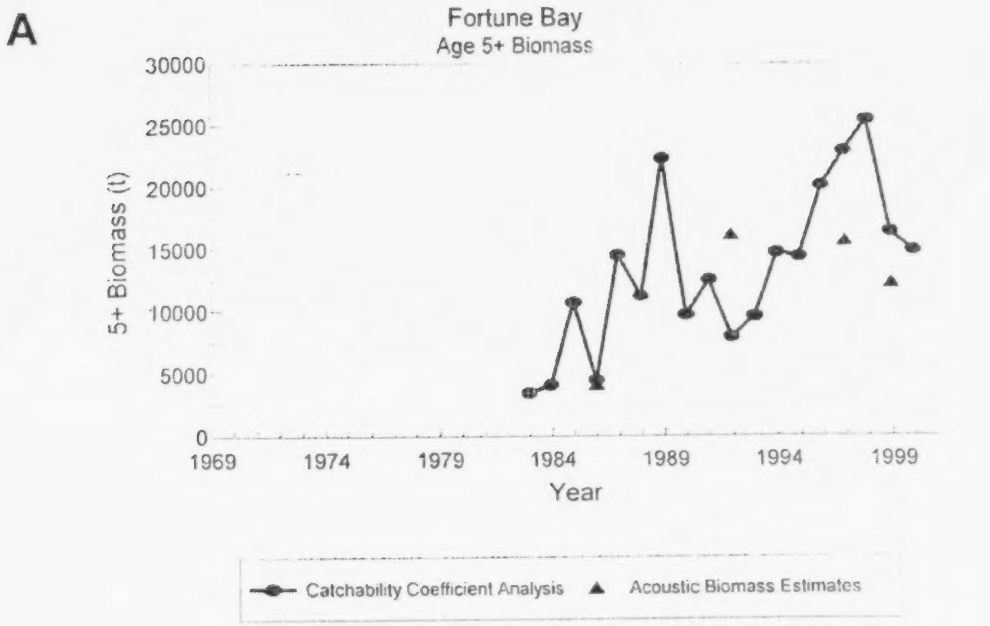


Figure 55. Panel A: Comparison of age 5+ biomass estimates from ICA with abundance indices. Panel 2: Stock status classification zones and projected 2001 mature biomass estimate.



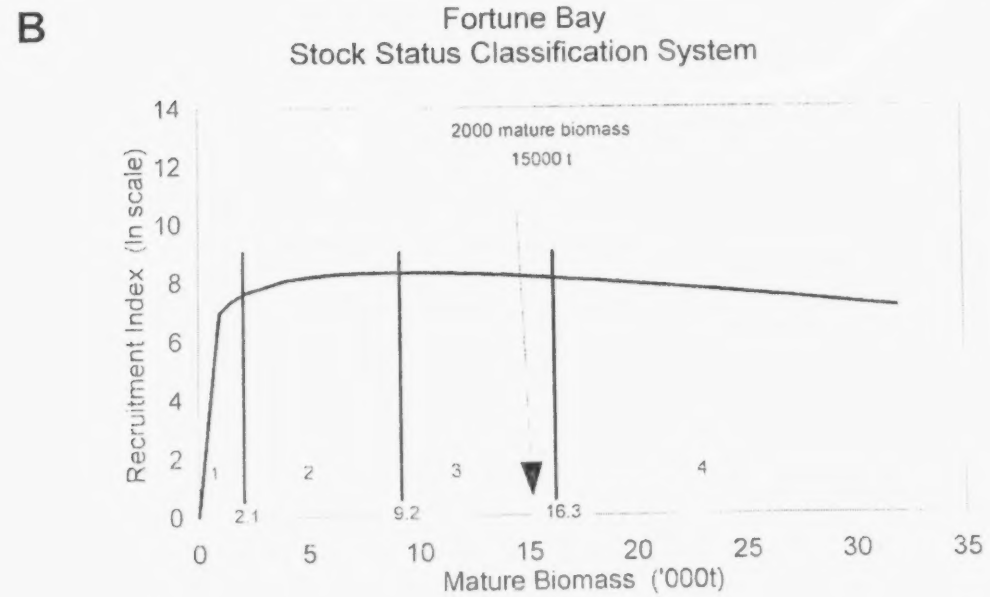


Figure 56. Panel A: Comparison of age 5+ biomass estimates with abundance indices. Panel 2: Stock status classification zones and projected 2001 mature biomass estimate.

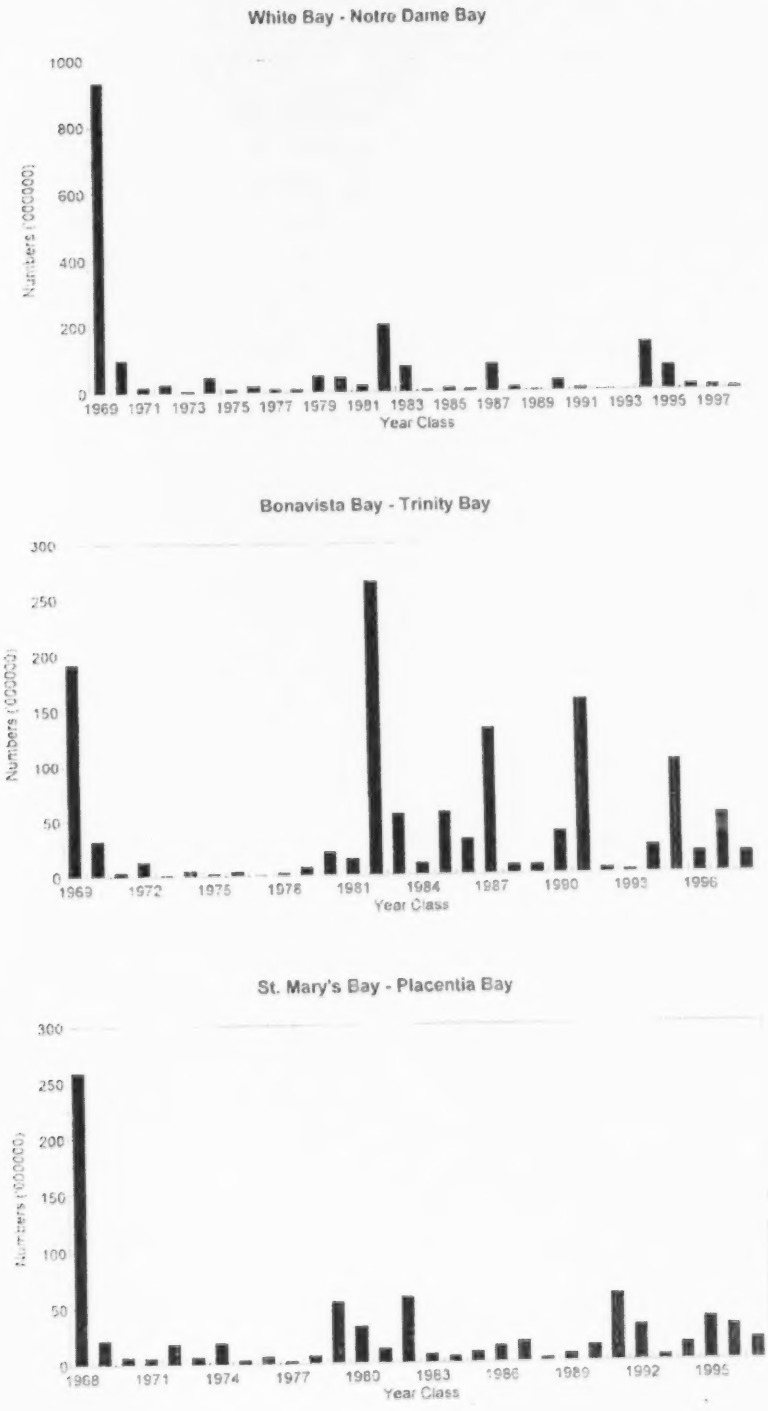


Figure 57. Estimates of recruitment of spring spawning herring at age 2, by stock area from integrated catch at age analysis.

Appendix 1. Commercial gill net logbook, revised in 1998.

Newfoundland East and Southeast Coast
2001 Herring Fixed Gear Logbook Program

Fishing Logsheets for the Enhanced Collection of Scientific Data

Name: _____

Mailing Address: _____

Community: _____

Postal Code: _____

Phone No.: _____

F.I.N. #: _____

Location Fished: _____

Net Mesh Size	Number of Nets Fished per Mesh Size	Size of Each Net	
		Length (fathoms)	Depth (fathoms)
2 1/4"			
2 1/2"			
2 5/8"			
2 3/4"			
2 7/8"			
3"			

Comments: _____

Please answer the following questions as accurately as possible:

1. Using a scale of 1 to 10, with 1 being the lowest and 10 being the highest, how abundant (fish numbers) were herring in your fishing area in 2001 ? (Check one box)

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [?]

2. Using a scale of 1 to 10, with 1 being the lowest and 10 being the highest, how abundant (fish numbers) were herring in your fishing area in 2000 ? (Check one box)

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [?]

3. Do herring spawn each year in your area? If so, in what geographical location(s)?

_____

4. Using a scale of 1 to 10, with 1 being the lowest and 10 being the highest, how intense was herring spawning in your fishing area in 2001 ? (Check one box)

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [?]

Please complete and return to:

John Wheeler
Science, Oceans, and Environment Branch
Dept. Fisheries and Oceans
P. O. Box 5667
St. John's NF A1C 5X1

Appendix 1 (cont.'). Commercial gill net logbook, revised in 1998.

Newfoundland East and Southeast Coast
2001 Herring Fixed Gear Logbook Program

F.I.N.# _____

Month	Day	Number of Nets Hauled and Nights Fished by Mesh Size											
		2 1/4"		2 1/2"		2 5/8"		2 3/4"		2 7/8"		3"	
		# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished

Appendix 2. Assessment Review Proceedings

Assessment Deliberations

Prior to the assessment meetings, the Herring Working Group of the Small Pelagics Advisory Committee met on October 16, 2000. An overview of all information available for the assessment was presented to the group for their review and comments. There was general agreement among members of the Working Group that the information provided reflected their views of stock status. There were several comments and questions. It was noted by fishers that small herring were abundant in White Bay in 1999 but disappeared in 2000. This has been the case for several years, ie. good evidence of small herring but never materalizing as large herring. It was suggested both by fishers and the assessment biologist that increased predation by seals may be a factor limiting herring stock sizes along the northeast coast. With regard to the commercial gill net logbook program, it was suggested by a fisher to check on the number of fixed gear licences by bay to better understand why logbook return rates have been so low. The assessment biologist recommended to fishers to stress the importance of these logbooks to other fishers in their respective areas. Another fisher suggested that commercial gill net fishers be contacted after the fishery each year to record their views regarding abundance in a similar manner to the purse seine questionnaires. The assessment biologist indicated that this may not be possible due to limited resources within Science. There was a general comment that too many conclusions were being drawn from limited data from both the commercial gill net logbooks and from the research gill net program. A specific point was raised regarding the commercial gill net fishery in Trinity Bay. Information from the commercial gill net logbooks indicated increased catch rates in the area in 1999 and 2000. This was contrary to research gill net trends in the same area. It was suggested that prior to 1999, there was little interest in the gill net fishery in the area due to poor market conditions. However, in 1999 and 2000, markets were available and there was increased interest. Consequently, in these years, the fixed gear fishery became more mobile, with fishers moving their gear to target known concentrations of herring. The research gill net program, fixed in location, would not necessarily detect similar trends.

An ad hoc Regional Assessment Review Committee met on October 16th, 19th, and 27th, 2000 to review the status of east and southeast Newfoundland herring and to prepare a Stock Status Report. There was no Chair assigned by the Branch for the assessment; consequently, the meetings were coordinated by the assessment biologist, John Wheeler. Participants at the meetings included representatives from Science, Oceans and Environment Branch (Jim Carscadden, Brian Nakashima, Fran Mowbray, Brad Squires, Paul Williams, and Dale Parmiter) and from Fisheries Management Branch (Bruce Mayne).

During the first meeting on October 16, 2000, John Wheeler presented five working papers: 1) Description of the east and southeast Newfoundland 1998 and 1999 commercial herring fisheries and commercial catch at age, 2) Results from east and southeast Newfoundland herring commercial fixed gear logbooks for 1998 - 2000, 3) Results of east and southeast Newfoundland herring purse seine questionnaires for 1998 to 2000, 4) Results of the east and southeast Newfoundland herring research gill net program for 1998 - 2000, and 5) Distribution and abundance of Atlantic herring from acoustic surveys of: White Bay - Notre Dame Bay in November - December 1998, Fortune Bay in March 1999, Bonavista Bay - Trinity Bay in November - December 1999, northeast Newfoundland coast in January 2000, and St. Mary's Bay - Placentia Bay in March - April 2000. These papers

formed the basis of the assessment and have been incorporated in Research Document 2001/018. John Wheeler also presented ecological information from Hammill and Stenson (2000) on the increased consumption of herring in Atlantic Canada from 1990 to 1996.

There was a general discussion of the five working papers during the first meeting. It was noted that landings for bait purposes are not included with commercial catch statistics. It was questioned (but not resolved) whether the percentage of bait landings had increased in recent years due to the increased requirements for bait in the crab fishery. With regard to the commercial gill net log books, it was suggested that average soak time would be a better indicator of effort than nights fished. There were also questions regarding how many logs were from fishers who fished commercially rather than for bait only and if differences existed in the catch rates between the two. It was concluded that it would be difficult to use commercial gill net catch rates in a quantitative analysis due to the limited sample sizes. There were suggestions on how to increase the sample size of commercial gill net logbooks, including a directed phone survey or contacting selected fishers each month to remind them. With regard to the research gill net program, it was suggested that fishers be asked for perceptions of abundance in a similar manner to commercial gill net log books. A general discussion ensued regarding how stock sizes should be estimated. It was suggested that a more general approach could be taken and use the various abundance indices as indicators of stock status. It was concluded that, if possible, stock specific mature biomass estimates should be derived in a similar manner to the 1998 assessment of these stocks.

At the second meeting on October 19, 2000, a working paper was presented on the estimation of stock sizes of east and southeast Newfoundland herring to 2000. It was noted that changes had to be made to the input parameters of the integrated catch at age analysis for White Bay - Notre Dame Bay from the 1998 assessment for the model to run. Similarly, for St. Mary's Bay - Placentia Bay, the integrated catch at age analysis was possible to 1999 but not to 2000. There was a discussion of the impacts of these changes; however, the expertise was not available fully assess these changes. It was suggested that changes should be contemplated for future assessments of these stocks as the current model is marginalized and constricted by the available catch and effort data. There was a discussion regarding the increased consumption of herring by seals and the effect of this on mortality estimates in the integrated catch at age model. It was not possible to quantify these changes so mortality estimates were unchanged in the model. It was decided to include a section on the consumption estimates for seals in the stock status report. It was concluded to use the integrated catch at age analysis to estimate stock sizes for White Bay - Notre Dame Bay, Bonavista Bay - Trinity Bay, and St. Mary's Bay - Placentia Bay, and to use a catchability coefficient analysis to estimate Fortune Bay stock size. This follows the methods used in 1998.

A draft stock status report was circulated to assessment committee members on October 24, 2000 for their comments and review. At the third meeting on October 27, 2000, a final stock status report was drafted. This was submitted to the Director's office on October 31, 2000 for release to the general public. Editorial changes were requested by the Director on October 13, 2000. These were incorporated prior to the release of the stock status report on October 20, 2000.

Management Deliberations

The Herring Working Group of the Small Pelagics Advisory Committee met on October 16th to review the stock status report. As it had not yet been released by the Director's office (Science), a draft report only could be reviewed. The working group expressed some concern regarding the implications of quota reductions in White Bay - Notre Dame Bay and in Fortune Bay. The group concluded its meeting with a series of stock specific recommended catch levels, consistent with the stock status classification system.

The Small Pelagics Advisory Committee met in Gander on December 11, 2000 to provide recommendations for the 2001 - 2002 Integrated Herring Management Plan. An overview of the stock assessment process was provided by John Wheeler. The recommendations of the Herring Working Group were then presented for review.

A draft 2001 - 2002 Integrated Herring Management Plane was formulated based upon the recommendations of the Herring Working Group and the Small Pelagics Advisory Committee. Up to the time of publication of this Research Document, the final management plan had not been released.